Pages 7627–7656

PART II

FEDERAL REGISTER

VOLUME 28 NUMBER 145

Washington, Friday, July 26, 1963

Department of Commerce

National Bureau of Standards

Test Fee Schedules

Title 15—COMMERCE AND FOREIGN TRADE

Chapter II—National Bureau of Standards, Department of Commerce

SUBCHAPTER A—TEST FEE SCHEDULES

REVISION OF SUBCHAPTER

Pursuant to authority contained in 15 U.S.C. 275a the following revision, effective upon publication in the FEDERAL REGISTER, supersedes in its entirety Subchapter A, Chapter II, Title 15 of the Code of Federal Regulations previously issued.

Part
200 General.
201 Electricity.
202 Metrology.
203 Heat.
204 Radiation physics.
205 Analytical and inorganic chemistry.
206 Mechanics.
208 Metallurgy.
210 Building research.
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PART 200—GENERAL

Sec.
200.1 Tests performed by the National Bureau of Standards.
200.2 Location of laboratories.

AUTHORITY: §§ 200.1 and 200.2 issued under sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interpret or apply sec. 7, 70 Stat. 959; 15 U.S.C. 275a.

§ 200.1 Tests[1] performed by the National Bureau of Standards.

(a) *Statutory functions.* The National Bureau of Standards has been assigned the following functions (15 U.S.C. 271–282):

(1) The custody, maintenance, and development of the national standards of measurements together with the provision of calibration services related to these standards.

(2) The determination of physical constants and properties of materials.

(3) The development of methods for testing materials, mechanisms and structures and the testing of materials, supplies and equipment.

(4) Cooperation in the establishment of standard practices, incorporated in codes and specifications.

(5) Advisory services to Government agencies on scientific and technical problems.

(6) Invention and development of devices to serve special needs of the government.

The testing activities stem from the functions in subparagraphs (1), (3) and (4) of this paragraph. This schedule of fees lists the services that are available to the public.

(b) *Testing policy.* (1) The Bureau's principal emphasis is on those calibrations and other tests requiring such accuracy as can be obtained only by direct comparison with NBS standards. The public is urged to obtain secondary standardization services from qualified sources other than the National Bureau of Standards. Except in unusual circumstances calibrations and other tests are performed for the users of the equipment rather than for suppliers. Tests that the National Bureau of Standards undertakes are restricted to the following:

(i) Tests involving comparison of standards or instruments with NBS standards.

(ii) Tests of devices or materials to determine compliance with specifications or claims, only if the device or material is critical in national scientific or technical operations, and if suitable testing facilities are not available elsewhere.

(iii) Referee tests, to which subdivision (i) of this subparagraph does not apply, where private laboratories are unable to agree on the method of measurement, the results of tests, or the interpretation of these results: *Provided,* That the importance of the case justifies the test and that all parties agree in advance in writing to accept and abide by the findings of the National Bureau of Standards.

(iv) Cooperative tests with national or international standardizing organizations to develop standards or specifications of mutual interest.

(2) Tests of the following types are not made for private organizations or individuals:

(i) Tests of devices and materials regularly performed by commercial laboratories. (A Directory of Testing Laboratories, Commercial and Institutional, is available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pennsylvania.)

(ii) Tests of secret processes, or of inadequately described materials, devices, or processes.

(iii) Tests whose objective is public relations, advertising or sales promotion.

(3) Requests for calibration of any equipment may be declined if, in the Bureau's opinion, the equipment is not suitable for use as a plant or laboratory standard. The National Bureau of Standards reserves the right to decline any request for testing, temporarily or permanently, if the tests would interfere with other activities deemed by the Director to be of greater importance.

(c) *Request for tests.* (1) Except for specific tests listed in the fee schedule a preliminary letter, stating clearly the tests desired, should be sent to the National Bureau of Standards, Washington 25, D.C., or to the National Bureau of Standards, Boulder, Colo., as appropriate, prior to any shipment, to determine if and when and at which laboratory the Bureau can undertake the test. In general, the purpose of the test and the manner in which the results are to be used should be stated. A formal purchase order for the test should be sent prior to or at the time of shipment.

(2) A test number will be assigned by the Bureau to each item or group of items accepted, and this test number should be referred to in all subsequent communications. If the apparatus submitted has been previously calibrated by the Bureau, reference should be made in the letter or order to this test number.

(3) Acceptance of such orders does not imply acceptance of any provisions set forth in the purchase order contrary to the policy, practice or regulations of the National Bureau of Standards or the U.S. Government. (A statement to the effect that the National Bureau of Standards is an agency of the U.S. Government should satisfy other Government agencies with regard to compliance with Government regulations and executive orders.)

(d) *Packing, shipping, and insurance.* (1) Equipment sent to the Bureau must be properly packed by the applicant to minimize likelihood of damage in shipment and handling. Suggestions on packing and shipping are made in some sections of the fee schedule. In every case, the applicant should consider the nature of the equipment, pack it accordingly, and clearly label shipments containing fragile instruments or materials, glass, etc. The use of "security express" should be considered in shipping delicate instruments.

(2) Shipping charges both to and from the Bureau must be assumed by the applicant. It is generally impractical for the Bureau to prepay shipping charges and add this cost to the billing invoice. Return shipments are made by the Bureau in accordance with its judgment of the best method of shipping unless specific instructions are received. Such instructions should be clearly shown on the purchase order for the test. The Bureau cannot guarantee that instructions printed obscurely on the order will be followed. Parcel post shipments generally will be returned prepaid by the Bureau.

(3) When a test number has been assigned prior to shipment to the Bureau this number should be clearly marked on the shipping container. When a test number has not been assigned, an invoice, copy of the purchase order, or letter should be enclosed in the shipment to insure proper identification. The original purchase order should be forwarded to the National Bureau of Standards.

(4) The risk of loss or damage, either in shipment or in testing, must be assumed by the applicant. Any arrangements for insurance covering such risk must be made by the applicant, except that the Bureau will, in other than parcel post shipments, request the carrier to provide insurance coverage for a specified amount for return shipment if this is specified by the applicant on the face of the purchase order. If transit insurance is carried by the applicant this should be stated on the face of the purchase order, and in any case the purchase order should show the value of the equipment.

(e) *Identification.* The data reported in the Bureau's tests pertain only to the individual item or piece of apparatus tested. It is therefore essential that this piece be identified uniquely by an appropriate number or symbol. In most cases, the manufacturer's name and serial numbers are used. When such a number is lacking, the applicant should provide an alternative identifying mark. If none is found, the Bureau may apply an appropriate one, usually the Bureau's

[1] "Tests" as used herein includes calibrations.

test number for which an additional charge may be made.

(f) *Condition of apparatus.* All apparatus submitted for test must be in good operating condition. Repairs and adjustments should be attended to by the applicant prior to shipment. Apparatus not in good condition cannot be tested, nor can the Bureau undertake the repair or adjustment of any equipment, except by special arrangement. If it is evident that equipment has been abused or has not received proper care, a test ordinarily will not be conducted. If defects are found at the Bureau after a test has begun, this fact will be reported, the test may be terminated and a report issued summarizing such information as has been found, and a fee charged in accordance with the amount of work done.

(g) *Priority and time of test.* (1) In general, tests are undertaken in the order in which the requests are received, provided that the proper arrangements have been made and the information necessary for test performance has been received by the time the test is scheduled to start. When it is desired that apparatus be out of normal service for a minimum time, arrangements may in some cases be made in advance for the setting of a specific date for the test; in such cases shipment can then be made in accordance with this date.

(2) The time for the completion of tests depends on a number of factors. Some tests require considerable time in themselves, as is indicated in the fee schedules. The condition of submitted equipment, the test load in the Bureau's laboratories, and emergency work for the Government are other factors that enter into consideration. Time estimates made by the Bureau are therefore tentative.

(h) *Witnessing of tests.* The Bureau welcomes scientists and engineers who may wish to visit its laboratories and discuss test methods. However, visitors ordinarily will not be permitted to witness the actual carrying out of highly precise measurements because their presence introduces distraction that may lead to errors or delays. This policy may be waived in those cases where the visitor can be of service in setting up apparatus of a new or unusual nature, in the case of referee tests, or in other cases in which the legal validity of the result may require the presence of duly authorized witnesses.

(i) *Report of test.* Results of calibrations and other tests are issued as reports entitled "National Bureau of Standards Report of Calibration" or "National Bureau of Standards Report of Test," as appropriate. The report form used carries no special significance. Whenever formal certification is required by law, or to meet special conditions adjudged by the National Bureau of Standards to warrant it, a letter will be provided certifying that the particular item was received and calibrated or tested, and identifying the Report containing the results.

(j) *Use of test results.* (1) The results of tests are pertinent only to the particular device or specimen tested and their application to other items of the same lot or type may not be warranted and therefore is not authorized by the National Bureau of Standards. However, the Bureau may declare that an entire lot of nominally identical items does or does not meet stated requirements for acceptance on the basis of tests on a sample of instruments or objects drawn from the lot in accordance with an approved sampling procedure.

(2) The National Bureau of Standards does not "approve," "recommend," or "endorse" any proprietary product, or material as a class or group, and results reported by NBS shall not be used in advertising or sales promotion, or to indicate either explicitly or implicitly endorsement of the product or material by the National Bureau of Standards.

(k) *Fees.* (1) In accordance with 15 U.S.C. 271–282, fees are charged for all tests made for the public.

(2) This fee schedule is published subject to the above-mentioned basic act which authorizes the Secretary of Commerce, from time to time, to make regulations regarding the payment of fees, the limits of tolerance to be obtained in standards submitted for verification and related matters.

(l) *Billing charges.* The minimum billing charge for any test request accepted by the Bureau is $5.00, unless otherwise indicated in a particular fee schedule. If apparatus is returned without testing a minimum charge of $5.00 may be made to cover handling. Fees for tests include the cost of preparation of an original report. Copies of reports ordinarily are not issued to other than the recipient of the original, and are not issued unless the applicant has shown a technical need for them. Copies of reports requested subsequent to the date of tests will be supplied at a cost of $1.00 each. All checks should be made payable to NBS, Department of Commerce.

§ 200.2 Location of laboratories.

The calibrations listed in Parts 201 (low frequency), 202, 203, 204, 205, 206, 208, 210, and 215 of this subchapter are performed in the laboratories of the National Bureau of Standards at Washington (25), D.C. Many of the calibrations listed in Part 201 of this subchapter can also be performed at the NBS Boulder laboratories, although in some cases only over limited ranges. Calibrations listed in Part 201 (high frequency) of this subchapter are performed by the Radio Standards Laboratory of the National Bureau of Standards at Boulder, Colorado. In general, electrical calibrations at frequencies higher than 30 kc/s are made at Boulder and those at lower frequencies are made either at Washington or at Boulder. Inquiries concerning calibrations (giving full details of ranges, frequencies, burdens, etc.) and shipment of apparatus should be directed in accordance with the foregoing. If apparatus is to be calibrated at both high and low frequencies, arrangements should be initiated with the Boulder laboratories. The cost of shipping the apparatus between laboratories will be billed to the applicant.

PART 201—ELECTRICITY

NOTE: The calibration service covered by this Part includes the determination of the corrections for standard electrical and electronic measuring apparatus and their range-extending auxiliaries used at power and audio frequencies (up to 30 kc/s), high frequencies (30 kc/s to 300 mc/s) and microwave frequencies (above 300 mc/s).

The National Bureau of Standards does not test, except occasionally for other agencies of the Federal Government, electrical devices or supplies not directly related to the field of measurement. Tests of power transformers, motors, generators, relays, wiring, appliances, etc., should not be requested.

RESISTANCE MEASUREMENTS

PRECISION WIRE-WOUND RESISTANCE STANDARDS AND APPARATUS

Sec.
201.100 General.
201.101 Precision standard resistors.
201.102 Precision resistance apparatus.

RESISTANCE STANDARDS OTHER THAN WIRE-WOUND

201.103 Multi-megohm resistance standards—except wire-wound.

INDUCTANCE AND CAPACITANCE MEASUREMENTS

201.104 Standard inductors.
201.105 Standard capacitors.

ELECTROCHEMISTRY

201.201 Standard cells.

ELECTRICAL INSTRUMENTS

201.300 General.
201.301 Standard resistors for current measurements.
201.302 Volt boxes (fixed ratio voltage dividers).
201.303 AC–DC instruments and thermal converters (20 to 50,000 c/s, up to 50 amperes and 600 volts).
201.304 AC–DC wattmeters, single phase.
201.305 Watthour meters.
201.306 Current transformers.
201.307 Current transformer comparators (testing sets).

MAGNETIC MEASUREMENTS

201.400 General.
201.401 General magnetic measurements; normal induction and hysteresis.
201.402 Magnetic materials; A–C permeability and core loss.
201.403 Magnetic testing apparatus; mutual inductors, search coils and fluxmeters.

DIELECTRIC MEASUREMENTS

201.500 Dielectric constant and dissipation factor.

VOLTAGE RATIO AND HIGH VOLTAGE MEASUREMENTS

201.601 Voltage dividers.
201.602 Voltage transformers.
201.603 Voltage transformer comparators.
201.604 Kilovoltmeters.

HIGH FREQUENCY REGION

201.800 General.
201.801 Rf, rf-dc voltmeters, and thermal converters in frequency range of 30 kc to 400 Mc; from 0.2 to 500 volts.
201.802 Rf voltmeters and signal sources in the frequency range 30 kc to 900 Mc, from 1 microvolt to 0.1 volt.
201.803 Power meters, 30 kc/s to 400 Mc/s.
201.804 Impedance, 30 kc/s to 300 Mc/s.
201.805 Dissipative coaxial attenuators.
201.806 Waveguide below-cutoff (or piston) attenuators.
201.807 Coaxial directional couplers.

Sec.
201.808 Field strength meters, 30 cps to 1000 Mc.

MICROWAVE REGION

201.900 General.
201.901 Low level, continuous power measurements on waveguide bolometer mounts, bolometer - directional coupler combinations, and dry calorimeters.
201.902 Reflection coefficient magnitude measurement on waveguide reflectors (mismatches).
201.903 Frequency measurement on cavity wavemeters.
201.904 Attenuation measurements on attenuators.
201.905 Calibration of waveguide noise sources.

AUTHORITY: §§ 201.100 to 201.905 issued under sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a.

RESISTANCE MEASUREMENTS

INVOLVING PRECISION WIRE-WOUND RESISTORS

§ 201.100 General.

In general, §§ 201.101 and 201.102 apply only to apparatus embodying the following essential features:

(a) The resistance material should have a low temperature coefficient, should not change its resistance appreciably with time, and for low-valued coils should have a small thermoelectric power against copper.

(b) All wire standard resistors and the more important section of resistance apparatus for use in d–c circuits should be wound on metal or ceramic supports, preferably in a single layer. Electrical connections to the resistance material should be brazed in all cases in which the total resistance is less than 1,000 ohms. The resistance material should be protected against oxidation and other chemical action and should be annealed or aged by baking after winding.

(c) Precision standard resistors should be so adjusted as to give an accuracy of at least 0.02 percent without corrections. Precision resistance apparatus should be adjusted within 0.05 percent of nominal value.

(d) Because comparatively rapid changes in resistance take place in new apparatus, it is not advisable to calibrate new or repaired apparatus until at least two months after the resistors have been annealed and adjusted. Precision apparatus, known to be new, will be held in the laboratory (in the absence of other instructions) for at least a month, when the measurements will be repeated to determine the drift in value, if any. No extra charge is made for these later measurements. Occasionally during the course of calibration it is discovered that the standard or instrument under observation is defective and in need of repair. In such instances the item in question will be rejected and a fee equal to the published fee, in whole or in part, will be assessed commensurate with the effort expended before the calibration was halted.

(e) Unless otherwise stated, the tests listed are generally made using a direct current of such magnitude as to cause only a negligible heating of the resistance material. Calibrations of standard resistors, bridges and decade resistors consist of determinations of the resistance of the standards or of the resistance of the elements of the bridges or similar apparatus from which values corresponding to all possible readings can be computed. Measurements of potentiometers consist of determinations from which the ratios of the resistances corresponding to all possible readings can be computed. Precision standard resistors are ordinarily measured at a temperature of 25° C., while resistance apparatus is measured at room temperatures, usually from 22° to 25° C.

(f) The National Bureau of Standards does not calibrate portable self-contained test equipment having relatively low accuracy such as portable potentiometers, resistance test sets, and double-bridge ohmmeters. The accuracy of these devices is such that a complete detailed determination of corrections is not economically feasible. Apparatus of this type may be spot-checked by measuring known voltages or resistances with them. Adequate calibration services of this type can be obtained from a number of commercial testing laboratories.

§ 201.101 Precision standard resistors.

Standards of 10 ohms and less of the precision type provided with amalgamated current terminals and designed for oil immersion must be of the four-terminal type, that is, must have both current and potential terminals. The resistance of standards having nominal values in the range 0.0001 ohm to 100,000 ohms will usually be given to the nearest 0.0001 percent in terms of the calibrating unit (the legal unit) maintained by the National Bureau of Standards with a group of one-ohm standard resistors. Each report of calibration will state the accuracy of the reported value at the time of calibration. This accuracy will vary from 0.0001 percent for Thomas-type one-ohm standards to 0.002 percent for resistors of nominal value 0.001 ohm. Additional information regarding standard resistors may be found on the back of the report of calibration.

Item	Description	Fee
201.101a	Determination of resistance in oil bath at 25° C. For all standards having resistances in the range 0.0001 to 100,000 ohms, inclusive, provided they are adjusted within 0.05 percent of a nominal value which is itself a decimal multiple (or submultiple) of 1 ohm	$32.00
201.101b	Determination of resistance in oil bath at 25° C. For odd-valued standards not falling within the scope of item 201.101a	47.00
201.101c	Measurement of resistance in oil bath at 20, 25, and 30° C., and determination of temperature coefficient. Such measurements are made only when it is shown that the small changes in resistance resulting from necessary variations of the temperature from 25° C. are of importance	115.00
201.101z	For special calibrations not covered by the above schedule, advance arrangements must be made. Fees will be charged dependent on the time involved in making a calibration.	

§ 201.102 Precision resistance apparatus.

Corrections pertinent to apparatus of suitable quality submitted under this section will ordinarily be reported to a number of significant figures so chosen that normal variation of ambient conditions within the stated bounds of test conditions will not affect the corrections by more than a few units in the last place reported. Calibrations will be made at room temperature, usually 22° to 25° C.

Item	Description	Fee
201.102a	Precision decade and plug boxes. For decades not exceeding 10,000 ohms per step: (1) First point in each box	$15.00
	(2) Each additional point in same resistance box	5.00
201.102b	Megohm box, 10 sections each 100,000 ohms	145.00
201.102c	Wire-wound 0.1 to 100 megohm boxes with 10 equal sections—calibration with all sections in parallel	47.00
201.102d–1	Precision Wheatstone bridges	385.00
201.102d–2	Calorimetric bridges of all kinds	520.00
201.102e	Potentiometers, minimum steps 10 microvolts or more	220.00
201.102f	Potentiometers, minimum steps less than 10 microvolts	410.00
201.102g	Kelvin bridge ratio box	160.00
201.102h	Double ratio set for Kelvin bridge, with double set of fixed and variable arms	465.00
201.102i–1	Four dial precision resistive voltage divider	260.00
201.102i–2	Five dial precision resistive voltage divider	320.00
201.102i–3	Six dial precision resistive voltage divider or universal ratio set	350.00
201.102z	For special tests not covered by the above schedule, advance arrangements must be made. Fees will be charged dependent on the time involved in making the tests.	

RESISTANCE STANDARDS OTHER THAN WIRE-WOUND

§ 201.103 Multi-megohm resistance standards—except wire-wound.

Measurements made on resistors submitted under this section are accurate to 0.1 percent at the time of test if nominal values are in the range 10^6 to 10^{12} ohms; for higher-valued resistors the accuracy is 0.5 percent. In order that the reported results be of significance it is necessary that standards submitted for tests be made of suitable materials processed in such a manner that resistance values do not change rapidly with time. They should be so constructed and treated that the effect of relative humidity is minimized. The resistance of these standards usually depends on the magnitude of the applied voltage; the test voltage should therefore be specified. Each resistor should have an identifying number engraved on, or permanently attached to it.

Item	Description	Fee
201.103a	Determination of resistance of a resistor at 1 voltage (1.5 to 250 volts) at room temperature (23° C.) and humidity (50% R.H. or less) when the resistor has a nominal value between 10^6 and 10^{10} ohms	$25.00
201.103b	Determination of resistance of a resistor at 1 voltage (1.5 to 250 volts) at standard laboratory temperature (23° C.) and humidity (50% R.H. or less) when the resistance is higher than 10^{10} ohms but the current involved is not less than 10^{-12} ampere	40.00

Item	Description	Fee
201.103c	Determination of resistance of a resistor at each voltage (1.5 to 250 volts) at standard laboratory temperature (23° C.) and humidity (50% R.H. or less) when the current involved is less than 10^{-12} ampere but not less than 10^{-13} ampere.	$50.00
201.103z	For special tests not covered by the above schedule, advance arrangements must be made. Fees will be charged dependent on the time involved in making the test.	

Inductance and Capacitance Measurements

Note: Tests at radio frequencies are performed at the NBS Boulder Laboratories, Boulder, Colorado.

§ 201.104 Standard inductors.

(a) Inductors for use in a–c bridges are ordinarily tested at 100, 400, 1,000, or 10,000 cps at a room temperature of 23° C. and a relative humidity of 50 percent or less. Measurements at 10,000 cps are limited to standard inductors of value 0.1 henry or less. Most inductors used at 60 cps can be tested at 100 cps since the variation of inductance with frequency in this range is usually negligible. Purchase orders should state which frequency or frequencies are to be used for calibration purposes. A metal encased standard is calibrated with the case connected to the "low" terminal of the inductor unless other conditions are specified. Variable inductors used as circuit elements in laboratory set-ups are low-accuracy devices which do not come within the purview of the schedule and should not be submitted for calibration. "Q" values are not supplied for inductors calibrated under this schedule. Inductors intended for use as "Q" standards at radio frequencies should be referred to the Boulder Laboratories. Mutual inductors used in magnetic testing for calibrating ballistic galvanometers should be calibrated with direct current under item 201.403a.

(b) Accuracy: Inductance values and accuracy statements given in reports of calibration depend upon two factors: (1) The accuracy of the comparison of the client's inductor with the NBS working standards of inductance; (2) the uncertainty in the derivation of the unit of inductance which is embodied in the NBS working standards. In general, inductance values will be given to as many significant figures as are justified at the time of measurement. The accuracy figure given in each report of calibration takes into account factors (1) and (2) stated above and will vary from 0.02 percent to 0.2 percent depending upon the nominal value of the inductor and the frequency of the test current employed.

(c) Inductors can usually be shipped safely express but should be carefully packed to avoid damage to the coil fastenings and terminals.

Item	Description	Fee
201.104a	Determination of self or mutual inductance of a fixed inductor with non-magnetic core at one frequency, 100, 400, 1,000, or 10,000 cps	$30.00
201.104b	Determination at an additional frequency 100, 400, 1,000, or 10,000 cps, on an inductor tested under 201.104a	$20.00
201.104z	For special calibrations not covered by the above schedule, advance arrangements must be made. Fees will be charged depending upon the nature of the calibration.	

§ 201.105 Standard capacitors.

(a) Calibrations are ordinarily performed at 65, 100, 400, 1,000 and 10,000 cps with an ambient temperature of about 23° C. and a relative humidity of 50 percent or less.

(b) The accuracy stated in the report of calibration is determined in part by the accuracy of the NBS measurements and in part by the performance characteristics of the capacitor itself and is sufficiently broad to allow for variations in the stray capacitance at the connectors, variations in temperature of a few degrees C., considerable variation in relative humidity and atmospheric pressure, and frequency deviations of a few percent from the stated test conditions. Over the above frequency range, and in the capacitance range from 0.001 pf to 100 μf, the available accuracy usually lies in the range 0.002 percent to 0.5 percent.

(c) The capacitance value given is the equivalent parallel capacitance. In general a determination of the equivalent parallel conductance with high accuracy is not feasible; however, for solid dielectric capacitors an approximate value is given without additional charge.

(d) Continuously adjustable ("variable") capacitors are no longer calibrated by the National Bureau of Standards.

(e) In applying the following schedule to decade capacitance boxes the first entry (201.105a) applies to a determination of the zero capacitance and conductance of the box (all dials set at zero). The second entry applies to the determination of the capacitance and conductance added to the circuit when any one dial is advanced from zero to a specified setting, and at the frequency used in determining zero capacitance. For measurements at additional frequencies the schedule is applied in the same manner i.e., the higher fee is used for the first point (zero calibration) at the new frequency, and the lower fee applies to additional points at that frequency.

Item	Description	Fee
201.105a	Determination of either direct or grounded capacitance of a fixed capacitor or 1 section of a subdivided capacitor, with alternating current at 1 frequency from those listed above (201.105)	$35.00
201.105b	Determination of either direct or grounded capacitance of each additional point on the same subdivided capacitor submitted under item 201.105a	12.00
201.105z	For special calibrations not covered by the above schedule, advance arrangements must be made. Fees will be charged dependent on the time involved in making the calibration.	

Electrochemistry

§ 201.201 Standard cells.

(a) Unsaturated standard cells will be accepted for calibration by the National Bureau of Standards only from public utilities and others having operations of such a nature as to require calibrations by the National Bureau of Standards.

(b) Unsaturated cells normally require about two weeks for a complete calibration. The cells are kept in a thermally insulated cabinet and readings of their emf are taken daily for a period of ten days after the values have become reasonably constant. If the emf continues to fluctuate, or is unusually low, or if the cell shows other abnormal indications the nature of the failure is stated. Unsaturated cells are not likely to be injured by normal transportation (mail or express), if they are carefully packed. Shipment during very cold weather should be avoided because of the possible hazard from freezing.

(c) Saturated cells should be transported by messenger because they should never be inverted nor tipped more than 45°. In order that the reported values are of the highest accuracy the emfs of saturated cells are measured while they are kept 6 to 8 weeks in an NBS temperature-controlled oil bath or in their own thermo-regulated air bath.

Item	Description	Fee
201.201a	Cadmium standard cell (unsaturated type), determination of electromotive force with accuracy of 0.01 percent	$29.00
201.201b	Cadmium standard cell (saturated type), measurement of the first cell of a group at a fixed temperature of 28° C., in thermostatically controlled oil bath or at a fixed temperature in a thermoregulated air bath	58.00
201.201c	Each additional saturated cell of a group	29.00
201.201d	Cadmium standard cell (saturated type), measurement of the first cell of a group at any temperature between 20° C. and 35° C., except 28° C., in a thermostatically controlled oil bath	71.00
201.201e	Each additional cell of a group (at temperatures between 20° C. and 35° C., except 28° C., in a thermostatically controlled oil bath)	34.00
201.201z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

Electrical Instruments

§ 201.300 General.

(a) Indicating (pointer-and-scale) instruments should be calibrated quite frequently with d–c standards and ac–dc transfer instruments, or with stable d–c or a–c sources which are calibrated periodically in this way. Suitable standards and transfer instruments are now readily available commercially. Because of the necessity of frequent tests, a single d–c or a–c calibration of an indicating instrument has little permanent value. Thus in this category NBS ordinarily accepts for calibration only rms ac–dc instruments and thermal converters of 0.1 percent rated accuracy or better, for ac–dc difference tests only.

(b) NBS ac–dc difference tests consist of determination of the difference between quantities (current, voltage, or power) required to give the same re-

sponse (output) of an instrument or thermal converter on alternating current and on reversed direct current, as evaluated by comparison with an NBS ac–dc transfer standard. The alternating quantity, Q_a, required for a given response of the instrument or converter is then: $Q_a = Q_d (1+S)$ where Q_d is the average quantity required for this response on reversed direct current, as determined by d–c standards, and S is the small fractional ac–dc difference. Usually NBS ac–dc difference tests are made on each range of the instrument or converter. The differences depend on the ratios of the reactances of the components, and increase with frequency, but are small and relatively permanent over the rated frequency range of a well-designed instrument. Therefore, NBS tests are normally made only at the upper rated frequency on each range and at the lower rated frequency on one range. Ordinarily, the tests need not be repeated at intervals of less than five years, and then only if the instrument is to be used over the upper part of its frequency range.

§ 201.301 Standard resistors for current measurements.

(a) *Calibration.* NBS normally calibrates only resistors of 0.04 percent accuracy or better. Test results for suitable standard resistors for current measurements are usually reported to an accuracy of 0.01 percent.

(b) *Design.* A standard resistor for current measurements is a 4-terminal resistor, for which the resistance is defined as the ratio of the open-circuit potential difference between the potential terminals to the current through the current terminals. The resistance value will be definite and reproducible only if the current flow-pattern at the potential terminals is completely reproduced. This flow-pattern should be fixed by resistor design to be independent of the way in which current is introduced at the current terminals and of the location of leads on the potential terminals. In some instances where this has not been done the type and location of connections to the current terminals can be specified adequately to fix the flow-pattern at the potential terminals.

(c) *High-current resistors.* (1) Resistors for high currents (above about 1,000 amperes) require considerable power, so that their temperature rise between low and rated current, and the resulting change in resistance, will depend not only on their design, including means provided for dissipating heat, but also on the connecting bus bars and their junctions to the resistor. Bus bars of generous cross-section may carry away a significant part of the heat generated in the resistor; inadequate bus bars may actually contribute to the heating of the resistor. In addition, contact resistance at the points of connection to the bus bars, unless carefully minimized, may contribute appreciably to the heating. (Contact resistance of bolted connections depends on area of contact, cleanness of surfaces, and pressure.) Resistance determinations made in the laboratory at rated current may therefore be of little value because the working temperature conditions cannot be duplicated. The best experimental procedure to use in such cases is to place the standard in a temperature-controlled enclosure and measure its resistance with a comparatively low test current when it is heated uniformly to temperatures approximately that at which it will operate in service (201.301 d and e). From data at two or more elevated temperatures, combined with that at room temperature, a curve can be plotted from which the resistance at the operating temperature can be read, provided this temperature is determined by the user with the resistor under the actual operating conditions.

(2) Changes in resistance may also result from strains in the resistance element produced by mechanical forces incidental to clamping the resistor connections, as well as from inherent internal expansion constraints on resistor parts, or forces from the magnetic field produced by the current.

(d) *Test schedule.* Resistors when first submitted for test should be tested with about 20 percent of rated current and with full rated current; normally when resubmitted for test, determinations need be made only with 20 percent of rated current; once stability is proved, the resistor need not be recalibrated at intervals of less than two years.

Item	Description	Fee
201.301a–1	Initial determination of resistance of a single-range resistor or one range of a multirange resistor, at 30 percent rated current or less (current rating not to exceed 300 amperes)	$44.00
201.301a–2	Same as a–1 except current rating above 300 amperes but not to exceed 1,000 amperes	74.00
201.301b	Determination of resistance on another range of a multirange resistor, at 30 percent rated current or less (current rating not to exceed 300 amperes)	16.00
201.301c	Test according to item 201.301a or 201.301b having been made, for an additional determination at another test current (not to exceed 1,000 amperes)	22.00
201.301d	Additional determination of resistance at temperatures above room temperature at a current not greater than 30 percent rated, for first elevated temperature	74.00
201.301e	Additional determination of resistance of each additional elevated temperature, at a current not greater than 30 percent rated	18.00
201.301f	Twenty determinations of resistances corresponding to 9 plug positions and 11 slider positions of an adjustable low resistance standard, at 30 amperes	220.00
201.301z	For determinations of resistance at currents larger than 1,000 amperes and requiring unusual setups or procedures, and for special tests not covered by the above schedule advance arrangements must be made. Fees for such tests will depend upon the nature of the test.	

§ 201.302 Volt boxes (fixed ratio voltage dividers).

A volt box is a resistive voltage divider used to extend the range of the voltage measured by a potentiometer. Its ratio for any range is obtained by dividing the voltage across its input terminals by the open-ciruit voltage across the section to be connected to the potentiometer.

(a) *Calibration.* NBS normally calibrates only volt boxes for which the maker's stated ratio accuracy is 0.04 percent or better. Values of ratio are normally reported to an accuracy of 0.005 percent.

(b) *Humidity effects.* The insulating structure of a volt box is equivalent to a network of high resistances in parallel with one or more of its wire-wound precision resistance elements. Thus, changes in insulation resistance as a result of variations in surface or volume moisture may affect the ratios. Such ratio changes are normally less on low than on high ratios. This effect can be reduced or eliminated by constructions which provide built-in guard electrodes, maintained at appropriate potentials. Another effect of humidity is to produce changes in the values of the precision wire-wound resistors. The magnitude of this effect varies with coil construction and with wire size and coating. Because humidity effects may reach equilibrium only after days (or even weeks), it is recommended that laboratory humidity be held continuously at or below 50 percent.

(c) *Ambient temperature and self-heating effects.* Changes in ambient temperature should have little effect on ratio if all the resistance elements have the same temperature coefficient. However, self-heating as a result of sustained operation may significantly change the ratios because of unequal temperature rise in the various resistors. The magnitude of this effect depends on construction and coil arrangement, and on the power dissipated. It should: (1) Be less for low than for high ranges, (2) be greater for volt boxes that require higher current at rated voltage, (3) increase approximately with the square of the applied voltage, and (4) be entirely negligible at 20 percent of rated voltage on all ranges.

(d) *Suggested test schedule.* (1) Volt boxes should be tested at rated voltage. The first calibration test should also include a test at 20 percent rated voltage on one or more of the higher ranges, which are preferably selected by NBS. The equilibrium values at 20 and 100 percent rated voltage may be used to estimate the magnitude of the self-heating effects for the various ranges. Tests having once been made at 20 and 100 percent rated voltage, subsequent determinations need be made only at rated voltage, since the self-heating effect should not change with time.

(2) Once stability has been established, a volt box should not require recalibration at intervals less than two years.

Item	Description	Fee
201.302a–1	Determination of ratio on 1 range at rated voltage, not to exceed 1,500 volts, and at a ratio not to exceed 5,000/1	$67.00
201.302a–2	Determination as in (1) above except ratio not to exceed 10,000/1	100.00
201.302b	Determination of ratio at rated voltage on an additional range	16.00
201.302c	Determination at a reduced voltage on a range tested in 201.302a or b	9.00
201.302d	Test per range, at rated voltage, of a multi-range Guarded Standard voltage divider. (Design similar to that described in NBS RP1419.) Value normally reported to an accuracy of 0.001 percent	20.00

Item	Description	Fee
201.302z	For tests on volt boxes not covered by the above schedule advance arrangements must be made. Fees will be charged depending upon the nature of the test.	

§ 201.303 AC–DC instruments and thermal converters (20 to 50,000 c/s, up to 50 amperes and 600 volts).

Ordinarily only rms ac–dc instruments or converters of 0.1 percent rated accuracy or better are accepted for test, which consist of ac–dc difference determinations by the procedures of items 201.303 a to c. See § 201.300.

Item	Description	Fee
201.303a	Initial determination of ac-dc difference of an instrument or converter at one applied voltage or current, frequency from 20 c/s through 50,000 c/s	$33.00
201.303b	Each additional determination of ac-dc difference of the same instrument, converter, or set of converters, frequency from 20 c/s through 20,000 c/s	10.00
201.303c	Each additional determination of ac-dc difference of the same instrument, converter, or set of converters, frequency from 20,000 c/s through 50,000 c/s	20.00
201.303z	For special tests not covered by the above schedule advance arrangements must be made. Fees will be charged depending upon the nature of the test. For tests at higher voltages see 201.604.	

§ 201.304 AC–DC wattmeters, single phase (20 to 2,000 c/s, up to 15 amperes and 500 volts).

Ordinarily only single-phase ac–dc wattmeters of 0.1 percent rated accuracy or better are accepted for test, which consist of ac–dc difference determinations by the procedures of items 201.304 a to c. See § 201.300. Unless otherwise specified, these tests are made at 2 scale points at 0.5 power factor on a base range and 1 scale point at other combinations of ranges, followed by tests at unity power factor at 1 scale point on one or more ranges, depending upon the results obtained.

Item	Description	Fee
201.304a	Determination of the difference between the reading on reversed direct current and the reading on alternating current at the first scale point at which this difference is determined, at currents not to exceed 10 amperes	$44.00
201.304b	Determination of this difference at 1 scale point on an additional range, frequency, or power factor, at currents not to exceed 10 amperes	16.00
201.304c	Determination at each additional scale point with the same combination of range, frequency, and power factor, at currents not to exceed 10 amperes	7.00
201.304z	For frequencies greater than 70 c/s and for special tests not covered by the above schedule, advance arrangements must be made. Fees will be charged depending upon the nature of the test.	

§ 201.305 Watthour meters.

Except under unusual circumstances, only portable standard watthour meters (rotating standards) will be accepted for test. Tests consist of determinations of the percentage registration of the meter "as received". If meters are to be cleaned and adjusted this must be done before they are submitted for test. NBS does not undertake the cleaning and adjustment of meters and does not knowingly begin tests on faulty meters. Before tests can be started the test conditions must be completely specified by the user as to current and voltage ranges to be tested, frequency, applied voltage and current, and power factor. A guide listing a limited yet adequate schedule of tests is available at no charge. Test voltages should be chosen from the following values: 1, 2, or 4 times 110, 115, 120, 125, and 130 volts. Test current should be chosen from the following values: 1, 10, or 100 times 0.25, 0.5, 0.75, 1, 1.25, 1.5, 2, 2.5, 3, 3.75, 4, 5, 7.5 amperes (but not to exceed 100 amperes). Tests at other voltages or currents or at power factors other than 1.0 and 0.5 current lagging, will be considered as special tests, because rearrangements of circuits are required. (See 201.305z.) Unless otherwise specified, test runs on portable standard watthour meters (rotating standards) are approximately 100 seconds duration. The meters are energized for at least 30 minutes at rated voltage and current on one range before starting the test.

Item	Description	Fee
201.305a	Test at 60 c/s on one combination of range, applied voltage, and power factor, at not more than five current loads	$54.00
201.305b	Additional test on the same or an additional combination of range, applied current, voltage, and power factor	8.00
201.305c	Test of one or two additional meters simultaneously with first, under the same conditions as 201.305a, per meter	28.00
201.305d	Test of each additional meter simultaneously with the first, under the same conditions as 201.305b, per meter	4.00
201.305z	For special tests not covered by the above schedule advance arrangements must be made. Fees will be charged depending upon the time required for the test.	

§ 201.306 Current transformers.

(a) Calibration: NBS normally calibrates only current transformers of high quality for use as reference standards. NBS may decline requests for tests which are not to be used for establishing or checking a reference standard. If the transformer quality is stated in terms of ASA accuracy classes, calibration will normally be limited to transformers stated to be in the 0.3 percent class for one or more ASA burdens. NBS equipment is primarily designed for testing current transformers whose rated secondary current is five amperes. Results obtained at frequencies near 60 c/s will normally be reported to an accuracy of 0.05 percent in ratio and 1 minute in phase angle. However, in some instances the ratio can be reported to an accuracy of 0.02 percent and the phase angle to 0.5 minute.

(b) Test information: Tests cannot be started until information is furnished concerning the following conditions: (1) test frequency, (2) secondary test currents, (3) secondary burdens, (4) ranges to be tested. It is customary to make tests at secondary currents of 0.5, 1, 2, 3, 4, and 5 amperes.

(c) Transformer burden:

(1) Current transformers should be tested with burdens equivalent to the impedances imposed when the transformer is used as a reference standard. Inclusion of tests at ASA burdens is not recommended. The burdens listed in the American Standard for Instrument Transformers, C–57.13, are for rating purposes only and differ from the instrument burdens imposed on a reference standard. Large errors in measurement can result if the values of ratio and phase angle obtained with an ASA burden are used for the transformer when it supplies only an instrument burden.

(2) Preferably the burden should be specified in terms of the measured resistance and inductance, including the leads to connect the instruments to the secondary of the transformer. If this measurement cannot be made conveniently, it will suffice in most cases to state the name of the maker, the type, range and serial number of each instrument used in the burden, and the length and size of the wire of the leads used in the secondary circuit. Alternatively the burden may be stated in terms of the volt-amperes and power factor of the secondary circuit at the test frequency.

(3) The test equipment regularly used at NBS imposes a minimum test burden of about 0.16 ohm with a minimum inductance of about 10μh. (If the burden inductance is larger than 10μh, the minimum resistance is increased above 0.16 ohm.) Special test equipment and procedures must be used for burdens lower than 0.16, ohm, so that advance arrangements must be made and higher fees must be charged. In planning for the tests of a transformer it is therefore desirable to select a low burden, but one larger than this minimum, preferably not less than 0.2 ohm. The required total may be made up by incorporating resistance in the leads to the instruments.

(d) Multi-range current transformers, in which the same sections of primary windings are used in series and in parallel, usually have phase angles and ratio factors which are equal on the several ranges to within the accuracy needed for almost any measurement purpose. Hence a test at six values of secondary current on one range is nearly always sufficient to determine the characteristics of the transformer. Further tests, often made at 0.5 and 5 secondary amperes on each additional range, merely serve as a safeguard by means of which mistakes in winding may be detected. When the various ranges of a multi-range transformer are obtained by taps on either winding, this relation does not necessarily hold, particularly in the case of secondary taps; and tests in addition to the initial six-point test on one range should be made, using two values of secondary current on each of the ranges so obtained. Transformers of some designs, however, show very little difference in ratio factor and phase angle on the various ranges, and the Bureau should be consulted before tests on a large number of ranges are requested.

(e) Demagnetization: Unless otherwise specified, current transformers will be demagnetized before being tested. If it is desired to have a transformer tested as submitted (without demagnetization), this fact should be specifically stated.

(f) Test limitation at frequencies greater than 60 c/s: At 400 c/s, the maximum current range for which tests are made is about 200 amperes and the phase angle values are normally reported to an accuracy of 3 minutes; at 800 c/s there is a further reduction in the current range and accuracy. If the burdens at these higher frequencies are specified in terms of volt-amperes and power factor, the frequency for which these values are stated must be clearly indicated so that the proper burden resistance and inductance can be duplicated.

(g) Recalibration: At room temperature the ratio and phase angle under a specified test condition should be repeatable unless the core is magnetized. Once stability has been demonstrated a current transformer should not require recalibration at intervals less than five years.

Item	Description	Fee
201.306a-1	Determinations of the ratio and phase angle of a current transformer on one range at 1 frequency and 1 burden (not less than 0.2 ohm resistance) at not more than 6 values of secondary current, namely, 0.5, 1, 2, 3, 4, and 5 amperes unless otherwise specified; primary current not to exceed 500 amperes	$87.00
201.306a-2	Same as a-1 except primary current greater than 500 amperes but not to exceed 8,000 amperes	115.00
201.306b-1	Determinations of the ratio and phase angle at 1 value of secondary current on an additional combination of frequency, range, and burden (not less than 0.2 ohm resistance); primary current not to exceed 500 amperes	18.00
201.306b-2	Same as b-1 except primary current greater than 500 amperes but not to exceed 8,000 amperes	26.00
201.306c	Determinations of ratio and phase angle at an additional value of secondary current with the same combination of frequency, range and burden used in 201.306 a or b, primary current not to exceed 8,000 amperes	9.00
201.306z	For tests of current transformers at frequencies other than 25, 50, or 60 c/s, or with burdens less than 0.2 ohm resistance, or with primary currents greater than 8,000 amperes, and for special tests not covered by the above schedule advance arrangements must be made. Fees will be charged depending upon the nature of the test.	

§ 201.307 Current transformer comparators (testing sets).

Item	Description	Fee
201.307a	Determination of the values of current ratio and phase angle for settings of the dials of a current transformer comparator for 60 c/s (not exceeding 13 points on ratio dial and 15 on phase angle dial)	$265.00
201.307b	Determination according to 201.307a having been made, for 10 determinations at 25 c/s or for determinations on the second range of a double range comparator	40.00
201.307z	For special tests not covered by the above schedule, advance arrangements must be made. Fees will be charged depending upon the nature of the test.	

Magnetic Measurements

§ 201.400 General.

(a) A general discussion of magnetic principles and methods used in magnetic testing is given in NBS Circular 456, Magnetic Testing, issued in 1946. Copies can be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., price 10 cents.

(b) Tests in this field are for the most part made on samples which serve as standards to coordinate work in various laboratories and thus secure uniformity in commercial testing. For this purpose it is essential that the standard bars be very uniform in their magnetic properties. The National Bureau of Standards does not normally make routine acceptance tests of magnetic materials unless these specimens are to be used, at least temporarily, as standards. The standard dimensions of magnetic test specimens are given in §§ 201.401 and 201.402. It is occasionally possible to test specimens of unusual materials or shapes where the services of the National Bureau of Standards are needed in the development of new test procedures which are likely to be of importance in the industry. In such cases a full understanding of the problem should be developed by correspondence, or preferably by a visit which will permit direct discussion between the engineers concerned and our staff.

§ 201.401 General magnetic measurements; normal induction and hysteresis.

Specimens submitted for test should be of rectangular cross section, width not to exceed 3.0 cm (1⅛ in.); thickness not to exceed 1.0 cm (⅜ in.); for magnetizing forces from 0 to 300 or 0 to 5,000 oersteds, length to be not less than 25.4 cm (10 in.); for magnetizing forces in the range 100 to 5,000 oersteds, length to be not less than 7 cm (2⅝ in.). Specimens whose permeability is not greater than 4 may be of circular cross section, diameter not to exceed 1.27 cm (½ in.) but in any event cross-sectional area must be not less than 0.2 sq. cm (0.031 sq. in.).

Item	Description	Fee
201.401a	Determination of data for normal induction curve in the range 0-300 oersteds	$50.00
201.401b	Determination of data for normal induction curve in the range 100-5,000 oersteds	50.00
201.401c	Determination of data for normal induction curve in the range 0-5,000 oersteds	90.00
201.401d	Determination of data for demagnetization curve, 1 value of magnetizing force	60.00
201.401e	Same as 201.401d, each additional value of maximum magnetizing force	40.00
201.401f	Determination of permeability for specimens whose permeability is less than 4; first specimen	20.00
201.401g	Each additional specimen submitted at the same time	10.00
201.401z	For examination of material found to be unsuitable for test, or for special tests not covered by the above schedule, fees will be charged dependent on the cost of such examination or special test.	

§ 201.402 Magnetic materials; A-C permeability and core loss.

Test specimens should consist of the proper number of strips 3 cm (1³⁄₁₆ in.) wide and either 28 cm (11³¹⁄₃₂ in.) to 30.5 cm (12 in.), or 50 cm (19¹¹⁄₁₆ in.) long prepared in accordance with the specifications of the American Society for Testing Materials, A-34.

Item	Description	Fee
201.402a	Determination of total core loss at 60 c/s at 1 value of maximum induction	$45.00
201.402b	Same as 201.402a, each additional value of maximum induction	15.00
201.402c	Determination of a-c permeability at 60 c/s at 1 value of maximum induction	45.00
201.402d	Same as 201.402c each additional value of maximum induction	15.00
201.402z	For examination of material found to be unsuitable for test, or for special tests not covered by the above schedule, fees will be charged dependent on the cost of such examination or special test.	

§ 201.403 Magnetic testing apparatus; mutual inductors, search coils, and fluxmeters.

Item	Description	Fee
201.403a	Determination of mutual induction by direct current	$30.00
201.403b	Same as 201.403a, each additional inductor submitted at the same time or each additional value for variable or tapped inductors	15.00
201.403c	Determination of the area-turns of a search coil, first coil	35.00
201.403d	Each additional search coil submitted at the same time	20.00
201.403e	Calibration of fluxmeter at not more than 5 points on 1 range	45.00
201.403f	Calibration of fluxmeter at 1 scale point on an additional range	10.00
201.403g	Calibration of Standard Magnets	30.00-70.00
201.403z	For examination of apparatus unsuitable for test, or for special tests not covered by the above schedule, fees will be charged dependent on the cost of such examination or special test.	

Dielectric Measurements

§ 201.500 Dielectric constant and dissipation factor.

In general, NBS will make tests of insulating and dielectric properties of materials only on: (1) Specimens of known composition of pure materials for which values are considered of use by the Bureau, or by other government agencies; and (2) dielectric reference standards made from materials exhibiting reproducible behavior under specified environmental conditions (such as humidity), when such standards are needed for improving methods of measurement. Measurements are not made on the effective insulation resistances, dielectric constant or dissipation factor of structures and assemblies of insulation, or on electric breakdown generally. Inquiries giving comprehensive information regarding any tests desired from low frequencies up to 30 kc/s should be directed to the National Bureau of Standards, Washington 25, D.C. Inquiries concerning tests above 30 kc/s should be addressed to the National Bureau of Standards, Boulder, Colorado.

Voltage Ratio and High Voltage Measurements

NOTE: See § 201.102 for information relative to the calibration of resistive voltage dividers with direct current. See § 201.302 for information relative to the calibration of volt boxes.

§ 201.601 Voltage dividers.

(a) The calibration of ratio devices such as voltage dividers need not be referred to the national standards of inductance or resistance or to any other national standard. However, methods and equipment are available at NBS for the measurement of alternating-voltage ratios with high accuracy, and a routine calibration service for first quality decade inductive voltage dividers is provided. Inductive voltage dividers which incorporate a resistive divider as a fine adjustment are not accepted for calibration.

(b) The largest contribution to instability in inductive voltage dividers often arises in the decade switches. Variable contact resistance in these switches sometimes affects the stability of voltage-ratio measurements to a significant extent but is most evident by its effect on the phase angle. When a decade inductive divider exhibits large changes in phase angle on repeated measurements after the switches have been disturbed, the divider should no longer be considered satisfactory for use as a standard of voltage ratio.

(c) Corrections for the separate decades of an inductive divider, in general, cannot be simply combined; however, the correction to a step setting of one of the higher decades is usually independent of the setting of the lowest decades. Stray impedances must be fixed by connecting the case to the divider at one point; and unless otherwise specified, the case will be connected to one of the common terminals. Calibration intervals of three years should be satisfactory for good quality inductive voltage dividers which have not been abused.

(d) Decade inductive voltage dividers are calibrated at NBS by a comparison method using as a working standard a well-constructed inductive divider which has previously been calibrated by capacitance-ratio methods. The comparison method is simple and convenient and can be used in other laboratories for the rapid calibration of other voltage dividers. Accordingly, it is recommended that, in general, only one divider from a laboratory be submitted to NBS for calibration and that other dividers be calibrated by a comparison method using it as a standard.

Item	Description	Fee
201.601a	Determination of the ratio and phase angle of an inductive voltage divider for each setting of each of the three highest decades (all decades except the one under test being set to 0) and for two arbitrary settings of all decades at one frequency (100, 400 or 1,000 c/s) and with an input voltage not exceeding 150v rms	$115.00
201.601z	Determinations of the ratios and phase angles of resistive or capacitive voltage dividers and of inductive voltage dividers beyond those covered in 201.601a are handled on a special test basis, and advance arrangements must be made. Fees will be charged dependent upon the nature of the test.	

§ 201.602 Voltage transformers.

(a) *Acceptance.* NBS normally accepts voltage transformers for calibration only if they are suitable for use as reference standards. Results of tests at or near 60 c/s will normally be reported to 0.01 percent in ratio and 1 minute in phase angle.

(b) *Test information.* Tests cannot be started until information is furnished concerning the following test conditions; (1) test frequency, (2) secondary test voltages, (3) secondary burdens, (4) ranges to be tested.

(c) *Transformer burdens.* The ratio and phase angle of a voltage transformer vary linearly with secondary current under conditions of constant voltage, frequency, and power factor within its rating. Hence, if values of ratio and phase angle are determined on open circuit (zero burden) and at one burden having a particular power factor, values at other current burdens with the same power factor (and at the same voltage and frequency) can be found by linear interpolation. If the ratio and phase angle of a voltage transformer are known both on open circuit (zero burden) and at a single unity power-factor burden, the ratio and phase angle for any burden within its rating at any power factor (at the same voltage and frequency) can be computed with sufficient accuracy for many measurement purposes by the following formulas:

$$F=F_0+\frac{I}{I_1}[(F_1-F_0)\cos\Phi+(\gamma_0-\gamma_1)\sin\Phi],$$

and

$$\gamma=\gamma_0+\frac{I}{I_1}[(F_1-F_0)\sin\Phi-(\gamma_0-\gamma_1)\cos\Phi].$$

Where I_1 and I are the secondary currents at the known unity power factor burden and the desired burden, respectively; F_0, F_1, and F are the ratio correction factors at zero burden, the known unity power-factor burden and the desired burden, respectively; γ_0, γ_1, and γ are the corresponding phase angles in radians; and $\cos\Phi$ is the power factor of the desired burden (Φ being taken as positive for inductive burdens). The following conversion factors apply:

1 minute = 0.000291 radian
1 radian = 3438 minutes

The "standard burdens" of the ASA Standard for Instrument Transformers (C57.13) are for rating purposes only, and are not recommended for use as test burdens in calibrating a voltage transformer for use as a reference standard. Values of ratio and phase angle at any ASA burden can be computed with sufficient accuracy for rating purposes by using the above formulas. The test burdens recommended are stated in items 201.602 a, b, or c below. In these items, the instrument burden "to be specified by the user", should preferably be the burden with which the transformer will be used as a reference standard, in the test circuit, and may be stated either in terms of volt-amperes and power factor at a specified voltage and frequency, or the resistance and reactance of the test circuit elements.

(d) *Test voltages.* When a secondary burden of fixed impedance is used, the ratio and phase angle of a well designed voltage transformer are nearly independent of the secondary voltage within its normal operating range. Hence, tests at a single voltage are sufficent unless the transformer is to be operated over an extended voltage range. In extended-range operation the variations of ratio factor and phase angle with voltage are identical for any constant-impedance burden. Hence, it should be sufficient to make ratio and phase-angle determinations at the extremes of the expected voltage-range of operation and at one or perhaps two intermediate voltage points on one burden (preferably zero burden). Tests at all additional burdens need be made at only a single voltage.

(e) *Multi-range transformer.* When multiple ranges are provided by series-parallel primary connections, the ratio correction factors and phase angles (for constant secondary voltage, burden, and frequency) are practically identical for all ranges so obtained. (Hence a single determination on each range after the first serves to completely define the transformer performance when the added ranges are obtained by primary series-parallel combinations.) When multiple ranges are obtained by tapping a portion of one of the windings, or by secondary series-parallel combinations, the ratio correction factors and phase angles are not necessarily the same on the various ranges.

(f) *Fuses.* It is recommended that voltage transformers intended as reference standards be used without fuses, because fuse resistance affects both ratio and phase angle values so that fuse deterioration or replacement may alter the values. When a fused transformer is submitted, tests with the fuses in place will be made only if this is specifically requested by the customer.

(g) *Tests at 400 c/s.* Ratio and phase angle determinations at 400 c/s can be made up to 9,000 volts. Results of such tests will normally be reported to 0.03 percent in ratio and 3 minutes in phase angle.

(h) *Recalibration.* The ratio and phase angle of a voltage transformer for a given burden, voltage, and frequency should not change significantly with time unless the transformer is damaged. Once stability has been demonstrated, a transformer should not require recalibration at intervals less than five years.

(i) *Shipment.* Heavy transformers should be shipped in wooden boxes and held in place, if necessary, by checks or cleats. Large transformers, especially those having oil-filled iron cases, should be crated separately and arranged, whenever possible, so that the terminals can be made accessible for tests without removing the entire crate. The tops of boxes should be marked "this side up". Large transformers (those more than 12 ft. high including crating, or weighing more than 6,000 lbs) require special handling; and advance arrangements, including provision for delivery inside the laboratory, must be made.

Item	Description	Fee
201.602a–1	Determinations of the ratio and phase angle of a voltage transformer at 1 frequency, 25, 50 or 60 c/s, 1 range and 1 secondary voltage, with not more than 4 values of secondary burden; namely, those giving zero, half, and full rated noninductive load at rated voltage, and with 1 instrument burden of approximately unity power factor to be specified by the user; primary voltage not to exceed 25,000 volts	$86.00
201.602a–2	As in a–1 except primary voltage greater than 25,000 volts but not to exceed 100,000 volts	120.00
201.602b	Determination of ratio and phase angle at 1 value of secondary voltage on an additional range or frequency, and with any of the burdens used in 201.602a	16.00
201.602c	Determination of ratio and phase angle with an additional burden (already used in 201.602a) and with the same combination of range, frequency, and voltage used in 201.602b	14.00
201.602d	Determination of ratio and phase angle at an additional burden of approximately unity power factor other than those used in 201.602a	40.00
201.602e	Determination of ratio and phase angle at an additional value of secondary voltage on the same combination of range, frequency, and burden used in 201.602 a, b, or c	8.00
201.602z	For tests of voltage transformers at other frequencies, with primary voltage greater than 100,000 volts or with other than unity power factor burdens, and for other special tests not covered by the above schedule, advance arrangements must be made. Fees will be charged depending on the nature of the test. At 400 c/s, test fees are approximately double those at 60 c/s.	

§ 201.603 Voltage transformer comparators.

Item	Description	Fee
201.603z	Calibrations of voltage transformer comparators are handled on a special test basis; however advance arrangements need not be made. Fees will be charged dependent upon the nature of the calibration required.	

§ 201.604 Kilovoltmeters.

Item	Description	Fee
201.604a	Calibration of kilovoltmeters at 5 scale points on one range using 60 c/s alternating voltage (up to 60 kv)	$80.00
201.604b	Calibration of kilovoltmeters at 5 scale points on one range using direct voltage of one polarity to ground (up to 60 kv)	80.00
201.604c	Calibration at one scale point on an additional range (up to 60 kv) for 201.604 a or b	21.00
201.604d	Calibration of each additional scale point on one of the ranges calibrated under 201.604 a, b or c	7.00
201.604z	For calibration at voltages above 60 kv, advance arrangements must be made. Fees will be charged dependent upon the nature of the calibration required.	

High Frequency Region

§ 201.800 General.

(a) (1) In the high frequency region of approximately 30 kc/s to 300 Mc/s and higher, the Electronic Calibration Center, Boulder Laboratories, is equipped to calibrate standards of voltage, power, impedance, attenuation, and field strength. These standards are limited at present to those designed for cw measurements and those having coaxial terminals (usually Type N connectors). No general provisions have yet been made for standards with balance transmission-line terminals.

(2) Stable rf power sources and detectors are required to perform such measurements. This is accomplished by use of crystal-controlled rf power sources and receivers. Rf power sources have power stabilization circuits that provide a power output constant to within 0.1 percent or better over periods of one hour or more. Special low noise, crystal-controlled receivers meet the exacting requirements to monitor or detect these signals. In using standards at high frequencies it is often desirable, and even necessary, to duplicate these conditions.

(3) Calibration services for high frequency standards are available at the fixed frequencies of 30, 100, and 300 kc/s, and 1, 3, 10, 30, 100, and 300 Mc/s. Calibrations are available at other frequencies for some standards, as well as continuous frequency coverage up to 1000 Mc for certain calibrations, but usually with less accuracy.

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(4) Type N connectors limit the accuracy of measurements in the high frequency region to some extent. To avoid instability from this cause, certain mechanical dimensions of Type N connectors used on interlaboratory standards should fall within tolerances specified by the Armed Services Electro Standards Agency (ASESA) in Procurement Specification MIL–C–71. If dimensions fall outside the specified tolerances, there is a possibility of damaging the mating connectors on interlaboratory standards and NBS working standards. Details for the Plug UG–21D/U are from Military Standard Drawing No. MS 91236 (supersedes Drawing No. AS–2110). Details for the Receptacle UG–22D/U or UG–23D/U are from Military Standard Drawing No. MS 91237 (supersedes Drawing No. AS–2110). This information can be procured from the Director, Armed Services Electro Standards Agency, Fort Monmouth, New Jersey.

(b) Fees: The fees to be charged for the following calibration services performed at the Boulder Laboratories are not fixed at this time but estimates will be furnished on request to those who plan to submit standards for calibration. However, these estimates are not binding and bills will be submitted for the actual costs incurred by the Electronic Calibration Center.

§ 201.801 Rf, rf–dc voltmeters, and thermal converters in the frequency range of 30 kc/s to 400 Mc/s; from 0.2 to 500 volts.

Ordinarily instruments equally suitable for use on dc and rf will be calibrated only for rf–dc difference by the procedure of item 201.801a, since periodic calibrations can be made by the user on reversed direct current. Such reversed d–c calibrations will be made at NBS only under unusual circumstances and by advance arrangement. Instruments suitable for use only on rf will be given rf calibrations by the procedures of items 201.801a, b. Instruments which respond to average or peak values or which are not in ASA accuracy class ¼ percent or better are not usually accepted for calibration below 30 Mc/s.

Item	Description	Fee
201.801a	Determination of voltage at 30, 100, 300, kc/s, 1, 3, 10, 30 and 100 Mc/s from 0.2 to 500 volts	(*)
201.801b	Determination of voltage at 300 and 400 Mc/s from 0.2 to 100 volts	(*)
201.801z	Special calibrations not covered by the above schedule	(*)

*See § 201.800 (b) Fees.

§ 201.802 Rf voltmeters and signal sources in the frequency range of 30 kc/s to 900 Mc/s, from 1 microvolt to 0.1 volt.

The Bureau normally issues reports of calibrations only on high quality voltmeters suitable for use as interlaboratory standards. These instruments should have a stability of one percent or better and an accuracy of three percent. Rf voltmeters will be calibrated by the procedures of items 201.802 a, b. Reports of calibrations are issued on signal sources high enough in quality to be considered as interlaboratory standards. If these instruments are equally suitable for use on dc and rf, they will be calibrated for ac–dc difference by the procedures of items 201.802 a, b, c. Signal sources suitable for use only on rf will be calibrated by the procedures of items 201.802 a, c.

Item	Description	Fee
201.802a	Determination of voltage for voltmeters and signal sources from 30 kc/s to 400 Mc/s, from 1 microvolt to 0.1 volt	(*)
201.802b	Determination of voltage for voltmeters from 400 to 1000 Mc/s, from 100 microvolts to 0.1 volt	(*)
201.802c	Determination of voltage for signal sources from 30 kc/s to 900 Mc/s, from 100 microvolts to 0.1 volt	(*)
201.802z	Special calibrations not covered by the above schedule	(*)

*See § 201.800 (b) Fees.

§ 201.803 Power meters, 30 kc/s to 400 Mc/s.

(a) For maximum calibration accuracy, interlaboratory rf power meters should repeat readings to one percent or better with a constant power input.

(b) At present only rf power meters utilizing Type N connectors for rf power input can be calibrated. If an adapter to a Type N connector is necessary, it must be sealed on the instrument prior to making measurements in order for the calibration to be valid. Refer to 201.800 for special requirements of Type N connectors used on interlaboratory standards.

Item	Description	Fee
201.803a	Calibration of r/f power meters at one frequency at 100, 300 kc/s; 1, 3, 10, 30 Mc/s; and at one power level from 0.001 to 200 watts	(*)
201.803b	Calibration of r/f power meters at one frequency at 100, 200, 300, 400 Mc/s; at one power level from 0.001 to 100 watts	(*)
201.803c	Each additional power level for the same instrument at the same frequency	(*)
201.803z	Special calibrations not covered by the above schedule	(*)

*See § 201.800(b) Fees.

§ 201.804 Impedance, 30 kc/s to 300 Mc/s.

(a) Maximum accuracy can be given only in the case of instruments and components equipped with connectors having a plane of reference directly compatible with the NBS system with no necessity for special adapters. For items equipped with connectors which must be adapted to the NBS system, reduced accuracies will be given depending upon the assessment of possible errors incurred. Power applied to any item under test will normally not exceed 1 watt. Where caution in this respect is necessary it should be clearly stated in the calibration request.

(b) All items in the following table are for grounded, two-terminal devices, with the exception of the direct or three-terminal capacitance services listed as items 201.804h and 201.804i.

Item	Description	Fee
201.804a	Impedance measurement at one point in the frequency range 30 to 400 kc/s; 100 to 10,000 ohms resistance, and 100 to 1100 microhenries inductance	(*)
201.804b	Each additional point within the limits in item 201.804a	(*)
201.804c	Impedance measurement at one point in the frequency range 30 kc/s to 1 Mc/s; 1 to 1,000 ohms resistance, and 1 to 110 microhenries inductance	(*)
201.804d	Each additional point within the limits in item 201.804c	(*)
201.804e	Admittance measurement at one point in the frequency range 30 kc/s to 1 Mc/s; 1 to 1100 micromhos conductance, and 10 to 1100 picofarads capacitance	(*)
201.804f	Each additional point within the limits of item 201.804e	(*)
201.804g	Admittance measurement at one point in the frequency range 5 to 100 Mc/s; 1 to 50 micromhos conductance, and 1 to 50 picofarads capacitance	(*)
201.804h	Direct capacitance measurement at 465 kc/s at one point in the range 0.001 to 100 picofarads	(*)
201.804i	Each additional point within the limits of item 201.804h	(*)
201.804j	Impedance measurement of coaxial components at frequencies from 50 to 500 Mc/s, within the ranges 0.5 to 5000 ohms for impedance magnitude and 0 to 90° for phase angle	(*)
201.804k	Q-Standard calibration in the frequency range 50 kc/s to 54 Mc/s, 0 to 1000 for effective Q and 30 to 450 picofarads for effective resonating capacitance	(*)
201.804z	Special calibrations not covered by the above schedule	(*)

*See § 201.800(b) Fees.

§ 201.805 Dissipative coaxial attenuators.

Dissipative coaxial attenuators are ordinarily calibrated in a system having characteristic impedance of 50+j0 ohms. Since mismatch affects calibration accuracy, the types of allowable connectors are limited. Only Type N connectors meeting MIL–C–70 Specification or flanged connectors having a known plane of reference compatible with those in use by NBS will be accepted. Maximum power to any attenuator will not exceed twenty milliwatts unless prior arrangements for higher power levels have been made. Calibrations are performed at the following frequencies: 1, 10, 30, 60, 100 and 300 Mc/s. The accuracy given will vary from 0.01 to 0.1 decibel, depending on the quality of the device.

Item	Description	Fee
201.805a	Fixed coaxial attenuators at one frequency. Range: 0–100 decibels	(*)
201.805b	One point on any resistive step attenuator at one frequency. Range: 0–100 decibels	(*)
201.805c	Each additional determination on resistive step attenuator at one frequency. Range: 0–100 decibels	(*)
201.805z	Special calibrations not covered by the above schedule	(*)

*See § 201.800(b) Fees.

§ 201.806 Waveguide below-cutoff (or piston) attenuators.

Waveguide below-cutoff attenuators are ordinarily calibrated in a system having a characteristic impedance of 50+j0 ohms. Only connectors meeting the MIL–C–71 Specification or flanged connectors having a known reference plane compatible with those in use by NBS will be accepted. Maximum power to any attenuator will not exceed twenty milliwatts unless prior arrangements have been made. Calibrations are performed at the following frequencies: 1, 10, 30, 60, 100 and 300 Mc/s. The accuracy given will vary from 0.01 to 0.1 decibel depending on the quality of the instrument.

Item	Description	Fee
201.806a	One increment on a variable piston attenuator at one frequency. Range (including initial insertion loss); 20–110 decibels	(*)
201.806b	Each additional increment calibrated at one frequency (same range as above)	(*)
201.806z	Special calibrations not covered by the above schedule	(*)

*See § 201.800(b) Fees.

§ 201.807 Coaxial directional couplers.

Directional couplers are calibrated in accordance with § 201.805. Terminations must be supplied for any arm not used during a measurement. Connectors, accuracy, and frequency in accordance with § 201.805.

Item	Description	Fee
201.807a	Single insertion loss measurement between any two arms at one frequency. Range: 0–100 decibels	(*)
201.807z	Special calibrations not covered by the above schedule	(*)

*See § 201.800(b) Fees.

§ 201.808 Field strength meters, 30 cps to 1000 Mc/s.

(a) Field strength standards and field strength meters are calibrated in terms of cw signals in the frequency range from 30 cps to 1000 Mc/s. Loop antennas are calibrated in the frequency range from 30 cps to 30 Mc/s, and horizontally polarized dipole antennas are calibrated from 30 to 300 Mc/s. The magnitude of the calibfating fields vary from approximately 25 to 200 mv/m for loop antennas, and approximately 50 mv/m for dipole antennas. The accuracy of the antenna calibrations varies from 3 to 15 percent depending on the frequency and the quality of the instrument.

(b) The internal characteristics of field strength meters, such as: the overall linearity of the receiver, accuracy of the signal input attenuators, and the accuracy of the receiver as a two-terminal rf voltmeter can be measured at frequencies from 30 cps to 1000 Mc/s. The accuracy of these measurements varies from approximately 1 to 10 percent depending on the frequency and quality of the instrument.

(c) When field strength standards or meters are submitted for calibration an instruction manual and all accessories should be included, and the instrument should be in perfect operating condition.

Item	Description	Fee
201.808a	Calibration of loop antennas at one frequency, 30 cps to 30 Mc	(*)
201.808b	Calibration of loop antennas at frequencies additional to item 201.808a, 30 cps to 1 Mc	(*)
201.808c	Calibration of loop antennas at frequencies additional to item 201.808a, 1 to 30 Mc	(*)
201.808d	Calibration of dipole antennas at one frequency, 30 to 300 Mc	(*)
201.808e	Calibration of dipole antennas at frequencies additional to item 201.808d, 30 to 300 Mc	(*)
201.808f	Calibration of input attenuators at one frequency, initial step	(*)
201.808g	Calibration of additional steps of input attenuators in addition to item 201.808f	(*)
201.808h	Calibration of the overall linearity of receiver and output circuits at one frequency and one attenuator setting, initial point	(*)
201.808i	Calibration of overall linearity of receiver at other points in addition to item 201.808h	(*)
201.808j	Calibration of the receiver as a two-terminal rf voltmeter, 1 to 1000 microvolts, 0 to 400 Mc, at one frequency	(*)
201.808k	Calibration of the receiver as a two-terminal rf voltmeter at other frequencies in addition to item 201.808j	(*)
201.808l	Calibration of receiver as a two-terminal rf voltmeter, 1 to 1000 microvolts, 400 to 1000 Mc, at one frequency	(*)
201.808m	Calibration of receiver as a two-terminal rf voltmeter at other frequencies in addition to item 201.808l	(*)
201.808z	Special calibrations not covered by the above schedule	(*)

*See § 201.800(b) Fees.

Microwave Region

§ 201.900 General.

(a) (1) Microwave calibration services presently available in the Electronic Calibration Center, Boulder Laboratories include measurements in power, impedance, frequency, and attenuation.

The frequency range covered for each of the measurements is given below. Both coaxial and waveguide transmission lines are encountered in these frequency ranges.

(2) A factor seriously limiting the accuracy of measurements on coaxial transmission line components at microwave frequencies is the connector used to place them in the calibration system. To avoid instability from this cause, certain mechanical dimensions of Type N connectors used on interlaboratory standards should fall within tolerances specified by the Armed Services Electro Standards Agency (ASESA) in Procurement Specification MIL–C–71. If dimensions fall outside the specified tolerances, there is a possibility of damaging the mating connectors on interlaboratory standards and NBS working standards. Details for the Plug UG–21D/U are from Military Standard Drawing No. MS 91236 (supersedes Drawing No. AS–2110). Details for the Receptacle UG–22D/U or UG–23D/U are from Military Standard Drawing No. MS 91237 (supersedes Drawing No. AS–2110). This information can be procured from the Director, Armed Services Electro Standards Agency, Fort Monmouth, N.J.

(3) In performing microwave calibrations, a considerable amount of time usually is needed to prepare the system for measurement operation. Much of this preparation is related to the adjustment of the system to the frequency of operation selected for the calibration. Time and cost often can be reduced by minimizing the number of times the operating frequency of the calibration system must be readjusted. To help in achieving this reduction in costs, a list of suggested calibration frequencies is presented in the following table. These frequencies are suggested for use in connection with this schedule and for interlaboratory standards utilizing terminations consisting of the standard waveguide sizes given below in the list of Suggested Calibration Frequencies. It should be emphasized that the suggested frequencies are primarily for economy and for convenience to those requesting calibrations. In general the calibration instrumentation for the microwave region is intended to provide complete and continuous frequency coverage as appropriate for the various waveguide sizes. Those having need for calibrations at other than suggested frequencies can be accommodated.

EIA waveguide designation	Frequency range Gc	Suggested calibration frequencies Gc		
		No. 1	No. 2	No. 3
WR 284	2.60– 3.95	[illegible]	[illegible]	[illegible]
WR 187	3.95– 5.85	4.35	4.90	5.25
WR 137	5.85– 8.20	[illegible]	7.00	7.40
WR 112	7.05–10.0	7.75	[illegible]	[illegible]
WR 90	8.20–12.4	[illegible]	[illegible]	11.2
WR 62	12.4 –18.0	13.5	15.0	17.0
WR 42	18.0 –26.5	19.8	22.0	23.8
WR 28	26.5 –40.0	[illegible]	[illegible]	37.0

(b) **Fees.** The fees to be charged for the following calibration services performed at the Boulder Laboratories are not fixed at this time but estimates will be furnished on request to those who plan to submit standards for calibration. However, these estimates are not binding and bills will be submitted for the actual costs incurred by the Electronic Calibration Center.

§ 201.901 Low level, continuous power measurement on waveguide bolometer mounts, bolometer-directional coupler combinations, and dry calorimeters.

(a) Power measurements are made on barretter-type bolometer mounts having nominal resistance of 100 to 200 ohms at a bias current between 3.5 and 10 milliamperes, and on thermistor-type bolometer mounts having a nominal resistance of either 100 or 200 ohms at a bias current between 5 and 15 milliamperes.

(b) Power measurements are made on bolometer mounts at power levels from 0.1 to 10 milliwatts.

(c) Power measurements are made on bolometer mount-directional coupler combinations having coupling ratios from 3 to 20 decibels.

(d) Power measurements are made on dry calorimeters at power levels from 10 to 100 milliwatts.

(e) Power measurement devices are calibrated in waveguide size WR 90 over the frequency range of 8.2 to 12.0 Gc.

(f) Effective efficiency for bolometer mounts is defined as the ratio of the substituted dc power in the bolometer element to the microwave power dissipated within the bolometer mount.

(g) Calibration factor for bolometer mounts is defined as the ratio of the substituted dc power in the bolometer element to the microwave power incident upon the bolometer mount.

(h) Calibration factor for bolometer mount-directional coupler combinations is defined as the ratio of the substituted dc power in the bolometer element on the side arm of the directional coupler to the microwave power incident upon a non-reflecting load attached to the main-line port.

Item	Description	Fee
201.901a	Measurement of effective efficiency o bolometer mount at a single frequency	(*)
201.901b	Measurement of calibration factor of bolometer mount at a single frequency	(*)
201.901c	Measurement of calibration factor of bolometer mount-directional coupler combination at a single frequency	(*)
201.901d	Measurement of output voltage vs input microwave power for dry calorimeter at a single frequency	(*)
201.901z	Special calibrations not covered by the above schedule	(*)

*See § 201.900(b) Fees.

§ 201.902 Reflection coefficient magnitude measurement on waveguide reflectors (mismatches).

(a) Reflection coefficient measurements are made on reflectors producing a reflection coefficient magnitude in the range of 0.025 to 1.0.

(b) Reflectors must be fitted with standard types of waveguide flanges. The face of these flanges should be machined flat and smooth and should not contain protrusions or indentations. The connecting holes of the flange should by symmetrically and accurately alined to the rectangular waveguide opening.

(c) Reflectors are calibrated in waveguide size WR 90 over the frequency range of 0.2 to 12.4 Gc.

Item	Description	Fee
201.902a	Measurement of reflection coefficient magnitude of reflector at a single frequency	(*)
201.902z	Special calibrations not covered by the above schedule	(*)

*See § 201.900(b) Fees.

§ 201.903 Frequency measurement on cavity wavemeters.

(a) Frequency measurements are made on fixed or variable cavity wavemeters of either the reaction (one port) type or the transmission (two port) type.

(b) Frequency measurements are made on fixed or variable cavity wavemeters having coaxial terminals with Type N connectors (male or female) over the frequency range of 100 Mc to 10 Gc.

(c) Frequency measurements are made on fixed or variable cavity wavemeters having standard rectangular waveguide terminals with standard type waveguide flanges over the frequency range of 2.6 to 75 Gc.

Item	Description	Fee
201.903a	Measurement of resonant frequency of fixed cavity wavemeter	(*)
201.903b	Setting of adjustable cavity wavemeter at prescribed resonant frequency	(*)
201.903c	Calibration of dial setting vs frequency of variable cavity wavemeter at prescribed frequencies	(*)
201.903z	Special calibrations not covered by the above schedule	(*)

*See § 201.900(b) Fees.

§ 201.904 Attenuation measurements on attenuators.

(a) Attenuation difference measurements are made on step or continuously variable attenuators usually with the zero dial setting used as the reference position. Insertion loss measurements are made on fixed attenuators.

(b) Attenuation measurements are made over the attenuation range of zero to 50 decibels. This attenuation range can be extended to 70 decibels in some frequency ranges.

(c) Fixed attenuators terminated in coaxial transmission line must be fitted with Type N connectors and must provide a female connector at one port and a male connector at the other port.

(d) Attenuation measurements are made on attenuators having coaxial terminals over the frequency range of 300 Mc to 5.6 Gc.

(e) Attenuation measurements are made on attenuators having standard rectangular waveguide terminals over the frequency range of 2.6 to 26.5 Gc.

(f) Variable attenuators should have a repeatability of setting better than ±0.1 decibel.

(g) Attenuators having coaxial terminals should have a maximum VSWR not greater than 1.20 at either port.

(h) Attenuators having standard rectangular waveguide terminals should

have a maximum VSWR not greater than 1.10 at either port.

Item	Description	Fee
201.904a	Measurement of attenuation difference of direct reading variable attenuator at a single frequency and at prescribed dial settings	(*)
201.904b	Calibration of dial setting vs prescribed decibel values for indirect reading variable attenuator at a single frequency	(*)
201.904c	Measurement of insertion loss of fixed attenuators at a single frequency	(*)
201.904z	Special calibrations not covered by the above schedule.	(*)

*See § 201.900(b) Fees.

§ 201.905 Calibration of waveguide noise sources.

(a) Measurements under conditions of cw operation are made on a noise source (usually a gas-discharge tube), suitable as an interlaboratory standard, mounted in a waveguide structure.

(b) Waveguide mount must be fitted at one end with a waveguide flange compatible with the UG-39/U cover flange, and terminated at other end with a suitably matched load. Noise tube and matched load to be sealed in waveguide mount; these seals must remain unbroken for calibration to be valid.

(c) Waveguide noise source must exhibit a reflection coefficient no greater than 0.27 (VSWR=1.7).

(d) Direct current required for normal operation of the gas-discharge tube shall be less than 300 milliamperes, and great enough to prevent excessive plasma oscillations. Type of tube and conditions of starting and operating current shall be given.

(e) Calibrations are available at the selected frequencies of 9.0, 9.8, and 11.2 Gc.

(f) Calibration can be performed over a range of effective noise temperature of 800° K to 300,000° K (excess noise ratio range of 2.5 to 30 decibels).

Item	Description	Fee
201.905a	Calibration of waveguide noise source at a single frequency	(*)
201.905z	Special calibrations not covered by the above schedule	(*)

*See § 201.900(b) Fees.

PART 202—METROLOGY

PHOTOMETRY AND COLORIMETRY

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202.182 Photometric instruments and accessories.
202.183 Miscellaneous photometric measurements and tests.
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202.618 Density determination of solids and liquids.

AUTHORITY: §§ 202.181 to 202.618 issued under sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a.

PHOTOMETRY AND COLORIMETRY

§ 202.181 Lamp standards of candlepower and luminous flux.

(a) The Bureau is prepared to standardize incandescent filament lamps which have been properly seasoned, or to season and standardize lamps when necessary, or to furnish lamps (of the more common types and sizes) that have been seasoned and standardized, the respective fees being as given in test fee schedule in this section.

(b) A normal incandescent lamp when operated at constant voltage usually increases slightly in candlepower for a short time, the length of which depends upon the temperature of the filament. A relatively stable period is then reached, after which there is a progressive drop in the candlepower. Therefore, in order that a lamp may be useful as a photometric standard, it should be seasoned by a preliminary burning sufficient to bring it to the stable state. This seasoning is usually done by operating the lamp at a voltage somewhat higher than the normal operating voltage of the lamp.

(c) Lamps with coiled filaments are not usually satisfactory as standards unless they have been specially constructed for this purpose. In particular, lamps of this type are not suitable for standards of horizontal candlepower unless they are of the monoplane-filament projection type. This type of gas-filled lamp with clear bulb (items 202.181 a, b, and c) has been found to be satisfactory as a standard of horizontal candlepower when standardized with a diaphragm in front of the lamp. This diaphragm is slightly larger than the filament and allows only the light coming directly from the filament to reach the photometer. In addition, great care must be taken to orient such standards properly because their candlepower varies appreciably with change of angle around both a vertical axis and a horizontal axis. Recently made available are gas-filled standards of horizontal candlepower in tubular, inside-frosted bulbs with medium-bipost bases (items 202.181 d, e, f, and g) which are calibrated and used without a diaphragm and for which accurate orientation has been found to be much less critical. These inside-frosted lamps are recommended for use where reproducibility of candlepower to 1 percent or better is required.

(d) When lamps are submitted for standardization it is necessary that they be accompanied by a statement as to whether they have been seasoned. If they have been seasoned, the voltage at which they were burned and the number of hours should be given if known. It should be stated also whether they are to be standardized at a given voltage or current at the fees listed below or at a given luminous flux (lumens), candlepower, or color temperature at an increased fee. In the reports which are issued with standard lamps the voltage and the corresponding current and flux or candlepower are given. The Bureau cannot guarantee the permanence of these values, since all lamps change gradually with use.

Item	Description	Fee
	Incandescent lamps issued from stock as standards of luminous intensity or of luminous flux:	
202.181a	Clear bulb, approximately 120-volt lamps, horizontal candles in a specified direction, screw base, 100-watt size, calibrated at 105 volts, 1 lamp each	$35.00
202.181b	Same, 250-watt size, 1 lamp each	40.00
202.181c	Same, 500-watt size, 1 lamp each	42.00
202.181d	Inside-frosted, T-20 bulb, approximately 120-volt lamps, horizontal candles in a specified direction, medium-bipost base, 100-watt size, calibrated at 110 volts, 1 lamp each	47.00
202.181e	Same, 300-watt size, 1 lamp each	49.00
202.181f	Same, 500-watt size, 1 lamp each	51.00
202.181g	Same, 1,000-watt size, 1 lamp each	55.00
202.181h	Clear or inside-frosted bulb, approximately 120-volt lamps, screw base, luminous flux, 100-watt size, calibrated at 15 volts, 1 lamp each	33.00
202.181i	Same, 200-watt size, 1 lamp each	35.00
202.181j	Same, 500-watt size, 1 lamp each	47.00
202.181k	Additional fee for calibrating lamps on items 202.181 a to j inclusive at voltages other than those listed, each lamp	11.00

Item	Description	Fee
	Standardization seasoned incandescent lamps submitted for standardization, approximately 120-volt lamps, medium-screw, mogul-screw, or medium-bipost base:	
202.181l	Clear or inside-frosted bulb, horizontal candles in a specified direction, 100- to 1,000-watt sizes, 1 lamp each	$46.00
202.181m	Clear or inside-frosted bulb, luminous flux, 10- to 1,000-watt sizes, 1 lamp each	46.00
202.181n	Same as items 202.181 l or m, each additional lamp of same size submitted at the same time for calibration at approximately the same voltage	31.00
202.181o	Seasoning of incandescent lamps for standardization, and preliminary measurements, 10 to 200 watts, each lamp	7.00
202.181p	Same, other sizes and types up to 5,000 watts and all series-burning lamps	9.00
	Standardization of seasoned fluorescent and mercury lamps submitted for calibration:	
202.181q	Determination of luminous flux (lumens) of "white," "cool white," or "daylight" fluorescent lamps, 1 lamp	47.00
202.181r	Same, each additional lamp	23.00
202.181s	Determination of luminous flux (lumens) of mercury vapor lamps, 1 lamp	63.00
202.181t	Same, each additional lamp	35.00
202.181z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.182 Photometric instruments and accessories.

Item	Description	Fee
202.182a	Calibration of portable photometers and illuminometers, values from 1 to 1,000 foot-candles or equivalent luminance, one point on scale	$35.00
202.182b	Same, each additional point on same range	8.00
202.182c	Calibration of luminance (photometric brightness) standard at one luminance, nonchromatic and between 1 and 1,000 foot-lamberts	34.00
202.182d	Same, each additional setting	14.00
202.182e	Calibration of reference standard for Macbeth Illuminometer	34.00
202.182f	Standard of luminous directional transmittance (approximately 0.5 foot-lambert per foot-candle) supplied from stock, each	34.00
202.182z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.183 Miscellaneous photometric measurements and tests.

Item	Description	Fee
202.183a	Determination of luminous transmittance of neutral or colored filter, 1 sample	$33.00
202.183b	Same, each additional sample of approximately the same transmittance submitted at the same time or at each additional color temperature of illuminant	10.00
202.183z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.184 Rating of incandescent electric lamps.

Item	Description	Fee
	Rating tests on lamps. These are routine photometric rating tests of the type made initially on lamps to be life-tested, the same standards and equipment being used. The purpose of these tests is to afford a quick check of the photometric values assigned to lamps by various lamp life-test laboratories. Lamp standards of candlepower or luminous flux are issued or calibrated under 202.181.	
202.184a	Rating of incandescent lamps up to 1,000 watts, 1 lamp	$22.00
202.184b	Same, each additional lamp of same size and type	5.00
202.184z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.185 Spectrophotometric standards.

Note on item a. Transmittances of these disks at wavelengths from 365 to 390 nm (nanometer, 10^{-9} meter) and from 750 to 1,000 nm will also be determined on request in accordance with item c of NBS test fee schedule 202.185. Values will be obtained for a temperature of 25° C. The effect of change of temperature has not been determined for these glasses outside the range from 390 to 750 nm. It is known, however, that for all four types of glass the temperature effects are very small from 750 to 1,000 nm, probably negligible for the usual room temperature variations. On the other hand, temperature effects are always large for these kinds of glass when the transmittance curve is decreasing rapidly towards shorter wavelengths, so that increasingly large temperature effects may be expected for these filters in the ultraviolet.

Note on items j and k. In the General Electric recording spectrophotometer the design is such that the radiant energy is incident in a slightly diverging beam whose axis is at 6° to the perpendicular to the surface. The specular component of the reflected energy is thus diverted away from the entrance aperture towards a port on the side. This port may be filled with MgO or with a black material, so that the specular component may be respectively "included" in, or (for plane surfaces) "excluded" from the measurements. This is covered in test fee items j and k.

Only one Vitrolite working standard is needed for the measurement of spectral directional reflectance on the General Electric recording spectrophotometer. This calibrated Vitrolite standard and the samples to be tested are in turn placed at the sample aperture of the integrating spheres, and any highly reflecting substance such as MgO or $MgCO_3$ may be used at the comparison aperture provided the material to be tested does not reflect more than the comparison material. The directional reflectances of the test samples relative to freshly prepared MgO are then obtained by multiplying (at the respective corrected wavelength) the values for these samples read from the curve sheet, by the ratios of (a) the standard Vitrolite values reported to (b) the values for the Vitrolite read from the curve sheet.

Item	Description	Fee
	Standards of spectral transmittance for checking the photometric scale of spectrophotometers; these consist of polished disks of glass, 2 to 3 mm thick and 30 mm in diameter, designated as cobalt blue, copper green, carbon yellow, and selenium orange (copper green filter also available in 25 mm square size); report includes (1) values of transmittance at 25° C., at certain wavelengths from 390 to 750 nm, (2) estimated uncertainty of each value, (3) effect of temperature change on transmittance at each wavelength:	
202.185a	Each disk	$100.00
	Transmittance, 365 to 1,000 nm for standardization purposes. Samples submitted must be in good optical condition. Measurements at room temperature. (If the sample is a disk 29.7±0.2 mm in diameter, the measurements can be made at a specified temperature):	
202.185b	One sample at one wavelength	30.00
202.185c	Each additional wavelength on the same sample	9.00
	Didymium glass standards for checking the wavelength calibration of General Electric recording spectrophotometers; these consist o. Corning 5120 glass, 2 by 2 inches, 3.0 mm thick, polished; report includes table of wavelengths of minimum transmittance:	
202.185d	400 to 750 nm, 10 nm slits, each standard	50.00
202.185e	730 to 1,080 nm, 20 nm slits, each standard	50.00
202.185f	For two calibrations on the same glass (items 202.185d and 202.185e), each standard	75.00
	Holmium oxide glass standards for checking the ultraviolet and visible wavelength calibrations of recording spectrophotometers with slit width less than 2 nm; these consist of Corning 3130 glass 2 by 2 inches, 2.5 mm thick, polished; report includes table of wavelengths of minimum transmittance:	
202.185g	240 to 370 nm, each standard	85.00
202.185h	360 to 650 nm, each standard	85.00
202.185i	For two calibrations on the same glass (items 202.185g and 202.185h), each standard	110.00
	Working standards of spectral directional reflectance for use on General Electric recording spectrophotometers with 6° from perpendicular irradiation and diffuse reception; standards consist of white structural Vitrolite glass, 4 by 4 inches, 5/16 inch thick; report includes table of spectral directional reflectances relative to freshly prepared magnesium oxide at every 10 nm:	
202.185j	400 to 750 nm, specular component both included and excluded (on same glass), 10 nm slits, each standard	110.00
202.185k	730 to 1,080 nm, specular component both included and excluded (on same glass), 20 nm slits, each standard	110.00
	Working standards of spectral directional reflectance for use on the Beckman Model DU quartz spectrophotometer with nearly perpendicular irradiation and approximately 45° circular reception; standards consist of white structural Vitrolite glass, 1½ by 2 inches, 3/16 inch thick; report includes table of spectral reflectances relative to freshly prepared magnesium oxide at every 10 nm:	
202.185l	380 to 770 nm, each standard	64.00
202.185m	750 to 1,000 nm, each standard	64.00
202.185n	350 to 1,000 nm, each standard	115.00
202.185z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.186 Spectrophotometric measurements.

The tests described in this section are primarily made for informational purposes, and samples so tested should not be accepted as "standards". All measurements are made at room temperature. For various types of spectrophotometric standards, see § 202.185.

Item	Description	Fee
	Spectral transmittance, 210 to 1,000 nm:	
202.186a	One sample at one wavelength	$43.00
202.186b	Each additional wavelength on the same sample	4.00
202.186c	Each additional sample, each wavelength	4.00
	Spectral directional reflectance relative to MgO, normal irradiation and 45° circular reception, as obtained with the Beckman Model DU spectrophotometer, 254 to 1,000 nm:	
202.186d	One sample at one wavelength	43.00
202.186e	Each additional wavelength on the same sample	4.00
202.186f	Each additional sample, each wavelength	4.00
	Spectral transmittance or transmittancy curves obtained on General Electric recording spectrophotometer, including 100% and zero calibration curves and didymium glass curve for checking the wavelength calibration; report includes ozalids of tracings:	
202.186g	Testing a single sample, 400 to 750 nm or 730 to 1,080 nm, with slits approximately 10 nm or 20 nm (respectively) of spectrum, either spectral range	58.00
202.186h	Each additional curve or each additional sample	9.00
202.186i	Same as 202.186g, but with both spectral ranges, 400 to 1,080 nm	80.00
202.186j	Each additional pair of curves or each additional sample	14.00
	Spectral directional reflectance curves obtained on General Electric recording spectrophotometer, including (1) Vitrolite calibration curve for correcting values relative to fresh MgO as 100.% (2) zero curve, (3) didymium glass curve for checking the wavelength calibration; report includes ozalids of tracings:	
202.186k	One sample, 400 to 750 nm, or 730 to 1,080 nm, with slits approximately 10 nm or 20 nm (respectively) of spectrum, with specular component of reflected energy included, or excluded, either specular range, and either condition of specular reflection	58.00
202.186l	Each additional curve or each additional sample, each curve	9.00
202.186m	Same as 202.186k, but both spectral ranges, 400 to 1,080 nm	80.00
202.186n	Each additional pair of curves or each pair of curves on each additional sample	14.00
202.186o	For reduction of data obtained as in 202.186g to 202.186n, giving table of values of transmittance, transmittancy, or directional reflectance relative to MgO for every 10 nm, for each curve	24.00
202.186z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.187 Colorimetry.

Item	Description	Fee
202.187a	Computing chromaticity coordinates and luminous directional reflectance or transmittance from spectrophotometric data for certain specified light sources, per source per sample	$13.00
202.187b	Computing luminous directional reflectance or transmittance from spectrophotometric data for certain specified light sources, per source per sample	9.00
202.187c	Determination of the Munsell renotation or book notation of a specimen from its daylight reflectance and chromaticity coordinates, each specimen	7.00
202.187d	Conformity to chromaticity of standard, sample and standard illuminated normally by artificial daylight or by incandescent-lamp light, chromaticity difference expressed in terms of chromaticity coordinates on fundamental colorimetric coordinate system, 1 sample relative to a standard	$31.00
202.187e	Each additional sample relative to the same standard	7.00
202.187f	Each additional sample relative to an additional standard	12.00
202.187g	Color temperature of 120-volt, screw-base incandescent lamp, voltage for specified color temperature, current for neighboring voltage to check permanence, 1 color temperature, each lamp	34.00
202.187h	Color temperature standard supplied from stock, 100-watt, medium-screw base or 500-watt mogul-screw base projection type lamp, calibrated for 2,854° K., 1 lamp each	34.00
202.187i	Same, calibrated for any one other specified color temperature, 1 lamp each	37.00
202.187j	Each additional color temperature on the same lamp	13.00
202.187k	Equation giving any color temperature from 2,000° K. to 2,854° K., each lamp, fee includes cost of 500-watt projection lamp	85.00
202.187z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.188 Reflectometry.

Standards issued: Standards have been prepared for use in the measurement of daylight 45°0° directional reflectance (45° illumination, perpendicular viewing) of paints, paper, textiles, ceramic products and other opaque materials. The standards are intended for use only with reflectometers designed to measure daylight 45°0° directional reflectance such as the multipurpose reflectometer developed at this Bureau. (Refer to Journal of Research NBS 25, 581 (1940) RP 1345.) Standards are available also for the tristimulus colorimetry of reflecting specimens of nearly the same spectral character. A detailed discussion of the method of photoelectric tristimulus colorimetry, its capabilities and limitations, is contained in NBS Circular 429 (1942). The standards are calibrated in terms of the CIE tristimulus values, X, Y, and Z. Information sheets describing these standards more fully are available on request.

Item	Description	Fee
	Standards issued	
	Nonselective standards—4¼ inches square with ¼ inch, 90 degree fold at each edge; in colors ranging from white through gray to black; calibrated for CIE tristimulus values, X, Y, Z:	
202.188a	One nonselective standard for tristimulus colorimetry	$44.00
202.188b	Each additional nonselective standard for tristimulus colorimetry ordered at the same time	17.00
202.188c	Set of 11 nonselective standards for tristimulus colorimetry	175.00
	KB chromatic reflectance standards—calibrated for CIE tristimulus values X, Y, Z; 3 x 5-inch plaques in colors commonly called white, bath green, kitchen green, orchid, ivory, maize, bath blue, delphinium blue, royal blue and red:	
202.188d	One KB chromatic standard	44.00
202.188e	Each additional KB chromatic standard	17.00
202.188f	Set of 10 KB chromatic standards in above listed colors	138.00
	8 chromatic reflectance standards—calibrated for CIE tristimulus values X, Y, Z; 4¼ inches square with ¼ inch, 90 degree fold at each edge; in colors commonly called safety red, aviation orange, safety orange, school bus chrome, safety yellow, safety green, and safety blue:	
202.188g	One 8 chromatic standard	$44.00
202.188h	Each additional 8 chromatic standard	17.00
202.188i	Set of 7 8 chromatic standards in above listed colors	102.00
	Samples or standards submitted for calibration	
	Directional reflectance relative to magnesium oxide or other standard, angles and apertures restricted to available instruments, for incandescent-lamp or artificial-daylight illumination, or for a spectral region determined by a source-filter-receptor combination:	
202.188j	One sample or standard under one set of experimental conditions	24.00
202.188k	Each additional sample or standard under same conditions, or each additional set of conditions	8.00
202.188z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.189 Opacimetry.

Opacity of diffusing glass by contrast-ratio (ratio of luminous directional reflectance with black backing to that with white backing), illumination nearly perpendicular to surface of glass, reception of all reflected flux regardless of angle. Reflectance of white backing taken so as to accord with Bausch & Lomb type photoelectric opacimeter correctly adjusted to read contrast-ratio for thin samples with a white backing reflecting 0.915 relative to MgO (Technical Association of the Pulp and Paper Industry test method T425m–36). Diffusing glass rectangles, 5 by 12 cm. supplied by the Bureau.

Item	Description	Fee
202.189a	Each diffusing-glass opacity standard, opacity between 0.60 and 0.96 as desired	$35.00
202.189b	Set of four diffusing-glass opacity standards, opacities approximately equal to 0.72, 0.79, 0.86, and 0.93	105.00
202.189z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.190 Glossimetry.

Standards are available for checking the accuracy of glossmeters designed to measure specular gloss at 20°, 45°, 60°, 75°, and 85°, with corresponding apertures as prescribed by established methods of test such as those of ASTM (C346, D523, D1223), TAPPI (T480), PEI (T-18). Standards are generally 4¼ inches square, except 85° standards which are 3 x 9 inches. They are made of polished, ground, sand-blasted, or acid-etched glass, or of glazed ceramic tile as required to obtain desired gloss values and to approximate reflected light-flux distributions of various types of commercial material frequently measured for gloss. Standards can be furnished generally within 5 units of any specified gloss value. An information sheet describing

these standards more fully is available on request.

Item	Description	Fee
	Standards issued	
	Standards of specular gloss calibrated for particular geometry to any one of the published methods referenced above:	
202.100a	One gloss standard for a specified geometry	$40.00
202.100b	Each additional gloss standard ordered for the same geometry at the same time	12.00
202.100c	Set of 10 standards of 60° specular gloss calibrated according to ASTM Method D523; gloss values range from approximately 1 to 90 in approximately 10-unit steps	138.00
	Samples or standards submitted for calibration	
202.100d	One gloss sample or standard for each specified geometry	24.00
202.100e	Each additional gloss sample or standard submitted at the same time for the same geometry	8.00
202.100z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.191 Lovibond glasses.

Lovibond red glasses, determination of numeral on the additive (N'') scale established (by Priest and Gibson's adjustment set BS 9940) at this Bureau in 1927, the value given being effective value when the given red glass is used in combination with a 35-yellow glass, each glass to be engraved with the National Bureau of Standards test number and the numeral found for the glass.

Item	Description	Fee
202.191a	For testing a single red glass	$32.00
202.191b	For each additional red glass	10.00
202.191z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.192 Signal glass limit glasses and IPL calibrating filters.

(a) Railroad, highway (traffic), and aviation signal glasses for use as chromaticity limits or transmittance standards in accord with specifications approved by the cognizant technical association or government agency will be issued when available. The report of calibration includes chromaticity coordinates, luminous transmittance, or both as determined relative to national standards filters for the specified color temperature of source.

(b) Instrument Panel Lighting (IPL) calibrating filters are available in two-inch polished squares. They have the following designations (approximate chromaticity coordinates for color temperature 2854° K. are shown below in parenthesis): NBS 3056 (x=0.723, y=0.277), NBS 3114 (x=0.712, y=0.288), NBS 3215 (x=0.698, y=0.302), and NBS 3648 (x=0.667, y=0.333). The NBS 3215 filter defines the pale limit for airplane red instrument panel lighting and is usually used in pairs; the other types of filters listed are for calibrating photometers used for measuring panel luminance.

Item	Description	Fee
202.192a	Signal limit glasses, each	$100.00
202.192b	IPL calibrating filters, calibrated for chromaticity coordinates and transmittance for 2854° K., each	55.00
202.192c	Calibration for transmittance at an additional color temperature	10.00
202.192z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.193 Haze standards.

Standards are available for checking the accuracy of hazemeters designed to measure haze according to ASTM Method D1003. Standards consist of hazy cellulose acetate sheeting laminated between glass; they are 2-inch squares about ¼ inch thick. Several nominal haze values between 1 and 30 are usually available.

Item	Description	Fee
	Standards issued	
202.193a	One haze standard	$40.00
202.193b	Each additional haze standard ordered at the same time	12.00
202.193c	Set of four haze standards	62.00
	Samples or standards submitted for calibration	
202.193d	One haze sample or standard	24.00
202.193e	Each additional haze sample or standard submitted at the same time	8.00
202.193z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.194 Radiometry.

Item	Description	Fee
202.194a	Eye protective glasses—calibration for transmittance of ultraviolet, visible, and total radiation	$35.00
202.194b	Calibration of radiant energy meter for energy of 2537A	35.00
202.194c	Measurement of radiant flux of 2537A, from germicidal or sterilamp	35.00
202.194d	Standard of spectral radiance—lamp seasoned and calibrated for spectral radiance, from 0.25 to 0.75 microns	180.00
202.194e	Standard of spectral radiance—lamp seasoned and calibrated for spectral radiance, from 0.5 to 2.6 microns	250.00
202.194f	Standard of total irradiance—carbon filament lamp seasoned and calibrated for total irradiation at distance of 2 meters	79.00
202.194g	Standard of spectral radiance—lamp seasoned and calibrated for spectral radiance, from 0.25 to 2.6 microns	400.00
202.194h	Standard of spectral irradiance—quartz iodine lamp seasoned and calibrated for spectral irradiance from 0.25 to 2.6 microns	325.00
202.194z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

REFRACTOMETRY

§ 202.201 Optical instruments.

Item	Description	Fee
202.201z	Tests of telescopes, microscopes, binoculars, etc., to determine conformance to specifications of resolving power, aperture, alignment of axes, etc. Fees determined by the actual cost of the work.	

§ 202.202 Photographic objectives.

The following information is pertinent to the tests a to o in this schedule.

a. This test is applied to photographic objectives that are mounted in a lens barrel or shutter. A visual or a photographic method is used depending upon the probable use of the lens. The back focal distance determines the lens position with respect to the focal plane for an airplane camera or other fixed focus camera focused for an infinitely distant objective. The equivalent focal length determines the scale factor for the interpretation of aerial photographs.

b. This test is given to the photographic objectives that are to be used in precision copying cameras. The information is used in calibrating the camera scales that enable the user to obtain the proper settings of lens, object plane, and image plane for any desired magnification without visual focusing.

c, d. The test includes the information obtained in 202.202b, together with information on distortion. It is applied to photographic objectives that are to be used in precision copying cameras where the user wishes to be certain that the relative proportions of the image are not significantly different from those of the object. Since the distortion changes with magnification, it is advisable to specify a ratio for test that corresponds to the magnification most commonly used.

e. This is a general purpose test to determine the suitability of a lens so far as its definition characteristics are concerned. It is performed photographically. In general, if a lens yields satisfactory results when subjected to this test, it is probable that no additional test for lateral chromatic aberration is necessary, and the lens will doubtless perform satisfactorily for either black-and-white or color photography.

f. This is the qualifying test for photographic objectives intended for use in airplane mapping projects. It is a photographic test and the determinations are made for the plane of best average definition.

g, h. The f-number may be obtained by dividing the equivalent focal length of the lens by the diameter of the effective aperture. These tests are primarily of value in determining the accuracy of the geometric f-number markings at maximum aperture, and at additional specified apertures.

i, j. This test is applied to photographic objectives mounted in cameras. As the test is a photographic one requiring a time exposure, it is necessary that the stop be open when the lens is submitted for test. This is a useful test for nonprecision type airplane cameras where the collimation index markers are located in a detachable magazine.

k. This test is applied to the platen of a precision aerial mapping camera, which is the surface against which the film is pressed during exposure. It is a test to determine conformance to specifications requiring that the platen shall not depart from a true plane by more than ± 0.0005 inches.

l. This test is applied to photographic objectives mounted in cameras. It gives the same information as test 202.202f except for back focal distance. It is preferable that these lens characteristics be determined for the lens as mounted in a barrel shutter, but occasionally it is desirable to determine these quantities for the lens mounted in a camera. The shutter of the lens should be open when the camera is submitted for test.

m. This test is applied to a lens-camera combination that is to be used in photogrammetric mapping. It gives the departure of the principal point from the center of collimation which is the intersection point of lines joining opposite pairs of collimation index markers. Since it is necessary to determine the shift of the principal point re-

sulting from prism effect in the lens, the equivalent focal length of the lens as mounted in the camera is incidentally determined in this test which checks whether the lens has been properly mounted to yield best average definition throughout the image field.

This test cannot be performed on a camera having a detachable magazine which bears the collimation index markers. This is the preliminary test on a precision type camera to determine compliance with specifications. If no provision has been made for ready adjustment of the collimation index markers and the 90° condition is not satisfied, the camera is returned to the firm or agency submitting the camera with recommendations regarding the necessary adjustments. If the 90° condition is satisfied, but no provision has been made for ready adjustment of the principal point with respect to the center of collimation, the camera is returned with recommendations regarding the necessary adjustments.

n. If no provision has been made for ready adjustment of the lens in a transverse direction to properly position the principal point with respect to the center of collimation, or if this can be done by ready movement of the collimation index markers, this task is done in the course of the test. Following adjustment, the camera is checked and if satisfactory, pins are set to insure preservation of the space relations between collimation index markers and principal point.

When a camera is submitted for test, it is mandatory that the drill holes for the pins be already present in one of the members that move with respect to one another. In addition, a proper sized drill and reamer and a sufficient number of pins to perform the doweling must accompany the camera. It is desired that roll pins be submitted for this task.

Item	Description	Fee
202.202a	Determination of focal length and back focal distance	$26.00
202.202b	Determination of equivalent focal length, back focal distance, separation of nodal points, and thickness	38.00
202.202c	Determination of equivalent focal length, back focal distance, separation of nodal points, and distortion at 5° intervals from the center to edge of field for one specified ratio of object to image size	105.00
202.202d	Fee for each additional ratio	55.00
202.202e	Determination of resolving power at 5° intervals from center to edge of field for parallel light at one aperture	30.00
202.202f	Determination of back focal distance, equivalent focal length, distortion and resolving power at 5° intervals from the center to edge of the field. NOTE: This is the test usually required for lenses that are to be mounted in precision airplane cameras.	69.00
202.202g	Determination of equivalent focal length and true geometric f-number for one marked stop	35.00
202.202h	Fee for each additional stop	10.00
202.202i	Determination of focal length for lens mounted in camera	43.00
202.202j	Fee for each extra magazine	25.00
202.202k	Determination of compliance of camera platen with flatness requirements to ±0.0005 inches	15.00
202.202l	Determination of equivalent focal length, distortion and resolving power at 7.5° intervals from center to edge of field for lens mounted in camera	82.00
202.202m	Location of the principal point, and check of 90° condition for lens mounted in camera	95.00
202.202n	Setting the principal point and 90° condition, checking and doweling for lens mounted in camera	72.00
202.202z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.203 Optical components, spectacle lenses, goggle lenses, etc.

Item	Description	Fee
	Optical components	
202.203a	Determination of equivalent focal length of single component lens	$26.00
202.203b	Determination of a single radius of curvature (single surface or matched pair). Fee determined by the nature of the work required, minimum fee $56.00.	
202.203c	Determination of spherical and cylindrical power, axis of sphere, and axis of cylinder for a single spectacle lens	16.00
202.203d	Fee for each additional lens	10.00
202.203e	Determination of spherical and cylindrical powers, axis of sphere, and axis of cylinder for a single spectacle lens with bifocal segment	23.00
202.203f	Fee for each additional lens	15.00
	Sunglass lenses	
202.203g	Determination of refractive power, surface quality, and definition to determine compliance of a single sunglass lens with commercial standards	16.00
202.203h	Fee for each additional lens	10.00
	Goggle lenses	
202.203i	Determination of lens dimensions, refractive power, prismatic power and definition; and making drop test on a single hardened goggle lens to determine compliance with Federal Specification GGG-G-501b	16.00
202.203j	Fee for each additional lens	10.00
202.203z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.204 Refractometric instruments.

Every instrument submitted for test should be in good working order. The test slab or standard supplied by the maker, and the tables, if any, must accompany each refractometer. Upon request special attention will be given to such portions of the scale as may be of particular importance in the contemplated use of the instrument. Refractometers with compensators will be tested with "white" light unless otherwise specified. Refractometers without compensators will be tested only with sodium light unless otherwise specified.

Item	Description	Fee
202.204z	For special tests and calibrations of refractometric measurements, fees will be charged dependent upon the nature of the test.	

§ 202.205 Refractive indices.

When submitting media for index measurement, the temperature, wavelength of light (or spectral line), and approximate degree of desired precision should be specified. Liquid samples should usually be as large as 10 ml. Solids for item d, must be in the form of test slabs, approximately 1 x ½ x 3/16 inches, such as are commonly used for the adjustment of Abbe refractometers. Two surfaces must be pitch polished (plane within approximately one wavelength) and intersect at 90° to form an unbeveled edge.

Item	Description	Fee
	Index of refraction (±1×10⁻⁴) for D spectrum line for 1 liquid by precision Abbe refractometer:	
202.205a	Determination of index for single temperature	$29.00
202.205b	Determination of index for each additional sample submitted at the same time for same temperature, or for each determination and additional spectral lines for same temperature	11.00
202.205c	One index determination at each additional temperature	10.00
	Index of refraction (±1×10⁻⁴) for D spectrum line for 1 solid by precision Abbe refractometer:	
202.205d	Determination of index for 1 sample	16.00
202.205e	Determination of index for each additional spectrum line, C, F, or G	6.50
	Determination of index of refraction (±1×10⁻⁴) of solid submitted in form of 60° prism for one visible spectrum line:	
202.205f	Determination of index	26.00
202.205g	For each additional line in the visible spectrum	12.00
202.205z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.206 Polarimetric instruments.

Item	Description	Fee
202.206a	Calibration of polarimeters, saccharimeters, and quartz control plates. Fees determined by the nature and difficulty of the test.	

PHOTOGRAPHIC RESEARCH

§ 202.311 Photography.

The following information is pertinent to the tests a to f in this schedule.

a. American Standard Printing Transmission Density (Type P2–b) is measured on step tablets of 21 steps or less, with a densitometer calibrated to ±0.01 density or ±1 percent of the density, whichever is the greater. This type of density is the one most commonly employed in the photographic industry and is customarily implied when the type of density is not specified.

b. American Standard Diffuse Visual Transmission Density (Type V1–b) is measured on step tablets of 21 steps or less, with a densitometer calibrated to ±0.01 density or ±1 percent of the density, whichever is the greater.

c, d. The determination of the residual sodium thiosulfate content of processed photographic film is made according to American Standard Method PH4.8–1958 or the latest revision thereof.

Hypo concentrations less than 0.005 mg. per square inch are reported as "nil". When hypo concentration is 0.005 mg. per square inch or over, it is reported to one significant figure.

Each sample submitted should be properly identified, contain no image (slight fog permissible) and must be submitted immediately after processing.

Each sample submitted should be 6 to 8 inches in length and should be attached securely to request letter by stapling.

Samples are not returned since they are destroyed during the test.

e, f. The determination of residual sodium thiosulfate concentration of processed photographic paper is made according to American Standard Method PH4.30–1962 or the latest revision thereof.

Each sample submitted should be properly identified, contain no image (slight fog permissible) and be of such dimensions that 2 strips, 1 x 4 inches can be cut for test.

Item	Description	Fee
202.311a	Calibration of photographic step tablets for printing density, 1 sample	$25.00
202.311b	Calibration of photographic step tablets for visual density, 1 sample	25.00
202.311c	Residual sodium thiosulfate concentration of processed film, 1 sample	12.00
202.311d	Each additional sample for the determination of residual sodium thiosulfate in film submitted at the same time	2.00
202.311e	Residual sodium thiosulfate concentration of processed photographic paper, 1 sample	20.00
202.311f	Each additional sample for the determination of residual thiosulfate concentration of processed photographic paper submitted at the same time	5.00
202.311z	For special tests not covered by the above schedule, such as precise determination of contact printing density and measurements of resolving power of photographic materials, fees will be charged dependent upon the nature of the test.	

LENGTH

§ 202.401 Reference line standards of length.

Item	Description	Fee
202.401z	Calibrations of reference line standards to a higher precision than that provided in schedule 202.402 are regarded as special tests. Fees will be charged dependent upon the nature of the test; they may be approximately estimated as twice the corresponding fees of schedule 202.402.	

§ 202.402 Working line standards of length.

Item	Description	Fee
202.402a	Yard or meter working line standard—determination of the total length at room temperature to an accuracy of 0.001 mm if the character of the graduation justifies	$125.00
202.402b	Yard or meter working line standard—determination of the total length at an additional lower temperature to obtain the coefficient of expansion	110.00
202.402c	Yard or meter working line standard—determination of equal submultiples of a length, each	20.00
202.402d	Yard or meter working line standard—determination of any other single interval	55.00
202.402z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.403 Commercial line standards of length.

Item	Description	Fee
202.403z	Calibrations of commercial line standards of length to an accuracy of 0.01 mm or 0.0004 inch, if the character of the graduation justifies, are regarded as special tests. Fees will be charged dependent upon the nature of the test; they may be approximately estimated as one-half of the corresponding fees of schedule 202.402.	

§ 202.404 Steel tapes.

(a) Steel tapes accepted by the National Bureau of Standards as suitable for calibration will be issued a National Bureau of Standards Report of Calibration. Steel tapes are used for many types of long-interval length measurements. The varied requirements for the application of calibrated steel tapes to length measurements necessarily requires variance in type and location of interval markings and accessory attachments. Some tapes, although being of excellent quality and having application that justifies NBS calibration, are not necessarily suitable for use as reference tapes. (See paragraph b of this section.) Such steel tapes for which a Report of Calibration has been issued will be engraved with a National Bureau of Standards serial number for identification purposes. A steel tape considered by the National Bureau of Standards to be suitable for use as a reference tape for checking other calibrated or uncalibrated steel tapes, or for other appropriate uses, will also be engraved with a mark indicating the year of calibration. Reports of Calibration normally will indicate the measured lengths of intervals to the nearest 0.001 foot or 0.1 mm. Length values will be reported at 68° Fahrenheit (20° C.).

(b) A steel tape considered suitable for use as a reference tape, as defined above, should possess the following minimum requirements: The error in total length of the tape at the standard temperature of 68° Fahrenheit (20° C.) and at standard tension shall not exceed 0.1 inch per 100 feet (2 millimeters per 25 meters). The standard tension in 10 pounds (4.5 kilograms) for tapes 25 to 100 feet, or from 10 to 30 meters in length and 20 pounds (9 kilograms) for tapes longer than 100 feet or 30 meters. From the standpoint of inherent stability and to prevent the possibility of accidental displacement of reference graduations, a reference tape should normally possess the following characteristic: All interval graduation should be on a single piece of metal ribbon. This is usually construed to imply that the graduations should not be on pieces of solder, sleeves, thin plates or blocks bonded or attached to the tape, or on wire loops, spring balances, tension handles or other accessories liable to be detached or changed in shape.

Item	Description	Fee
202.404a	Steel tape—determination of correction to the total length of the tape when supported throughout at standard tension and at standard temperature, for a tape not exceeding 200 feet or 50 meters in length. This is the regular standard test which will be made and charged for in each case. To this amount must be added the fees for any additional tests made, and for item (n), if applicable, in accordance with the following schedule.	$21.00
202.404b	Steel tape—determination of the correction to the total length when supported throughout at any tension other than standard tension, for a tape not exceeding 200 feet or 50 meters in length. Tension desired must be specified.	4.00
202.404c	Steel tape—determination of the correction to the total length when supported at the ends only. The Bureau is not prepared to make this test on tapes having a greater length than 200 feet or 50 meters.	4.00
202.404d	Steel tape—determination of the correction to the total length when supported at the ends and one or more intermediate points, for a tape not exceeding 200 feet or 50 meters in length. Standard tension will be used unless another tension is specified.	4.00
202.404e	Steel tape—determination of the correction to length of a subinterval under the same conditions as to tension and points of support as for the total length. The points at which these measurements are made must be points at which the tape is supported. The Bureau is not prepared to test tapes supported at points more than 200 feet or 50 meters apart.	$3.00
202.404f	Steel tape—determination of the correction to the length of a subinterval under different specified conditions as to tension and points of support from those used for the total length. See item (e) above.	5.00
202.404g	Steel tape—determination of the tension to the nearest integral half-pound or quarter kilogram at which the correction to the length of an interval is most nearly zero, under a specified condition of support, for a tape not exceeding 200 feet or 50 meters	5.00
202.404h	Steel tape—determination of the correction to a subinterval at the tension at which the correction to the total length is most nearly zero and under the conditions of support used in the test under item (g)	3.00
202.404i	Steel tape—determination of correction to the total length of an interval on the reverse side of the tape, when supported at standard tension and at standard temperature, for a tape not exceeding 200 feet or 50 meters in length	5.00
202.404j	Steel tape—determination of the coefficient of expansion of a tape, fee will be determined in each individual case.	
202.404k	Steel tape—determination of Young's modulus of elasticity, for a tape not exceeding 200 feet or 50 meters in length. Not recommended for tapes having enameled, plastic, or heavy varnish coatings.	15.00
202.404l	Steel tape—determination of the weight per foot or per meter of a tape	6.00
202.404m	Spring balance—testing in horizontal position	10.00
202.404n	Steel tape—additional charge for each tape sent without reel	4.00
202.404o	Steel tape—determination of AE	10.00
202.404p	Steel tape—computed values (this does not include charge for necessary measurements)	5.00
202.404z	For special tests not covered in the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.405 Invar base-line tapes.

For testing of steel tapes, see schedule 202.404. The test of an invar base-line tape of any length less than 50 meters on our geodetic-tape comparator will, in general, be made for the same fee as a 50-meter invar base-line tape. Attention is called to the fact that only invar base-line tapes of certain lengths can be tested on this comparator. Invar tapes not tested on the geodetic-tape comparator will be tested on our bench standard under items 202.405 (l) and (m).

Item	Description	Fee
202.405a	Invar 50-meter base-line tape—determination on the geodetic comparator of total length with a probable error not greater than ±0.050 mm	$150.00
202.405b	Invar 50-meter base-line tape—determination on the geodetic comparator of total length at an additional tension and/or method of support, with a probable error not greater than ±0.050 mm	40.00
202.405c	Invar 50-meter base-line tape—determination of total length supported throughout, by computation from the observed length when supported at the ends and one or more intermediate points	20.00

Item	Description	Fee
202.405d	Invar 50-meter base-line tape—high precision calibration of a group of uniformly spaced subintervals when supported on a horizontal flat surface, using the same tension specified for test item 202.405c. Charge for each interval	$30.00
202.405e	Invar 50-meter base-line tape—determination on the geodetic comparator of the coefficient of expansion with an accuracy of at least 0.000001 per degree celsius using the electrical resistance method, and calibration of its total length at 1 temperature, tension, and method of support with a probable error not greater than ±0.050 mm	225.00
202.405f	Invar base-line tape—determination of Young's modulus of elasticity	15.00
202.405g	Invar base-line tape—determination of the weight per meter (or per foot)	6.00
202.405h	Spring balance—testing in horizontal position	10.00
202.405i	Invar base-line tape—additional charge for each tape sent without a reel	4.00
202.405j	Invar base-line tape—determination of AE	10.00
202.405k	Invar base-line tape—computed values other than as provided in item 202.405c	5.00
202.405l	Invar base-line tape not more than 50 meters in nominal length—determination on bench standard at room temperature of length of 1 interval when supported at 1 method of support and under 1 tension, or determination of the tension to the nearest integral half-pound or quarter kilogram at which the correction to the length of the interval is most nearly zero at a specified method of support	33.00
202.405m	Invar base-line tape not more than 50 meters in nominal length—each additional determination on bench standard at room temperature of length of interval, or tension to the nearest integral half-pound or quarter kilogram at which the correction to the length of an interval is most nearly zero	13.00
202.405z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.406 Surveyors' measuring instruments (other than tapes).

Item	Description	Fee
202.406a	Leveling rod—testing principal intervals	$48.00
202.406z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.407 Sieves.

Note: The precision seal of the National Bureau of Standards on any sieve indicates that the sieve has been tested at the National Bureau of Standards and found to conform to specification. Except by special arrangements, the testing of sieves at the National Bureau of Standards is limited to No. 2½ to No. 400 inclusive.

Item	Description	Fee
202.407a	Sieve—test of a sieve No. 2½ to No. 400 inclusive to determine conformity to specification, but not including the sieving test	$16.00
202.407z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.408 Haemacytometers.

Each haemacytometer chamber and each cover glass which passes the specification is marked with a National Bureau of Standards precision seal. In general, work will be discontinued when a substantial number of items in a lot fail to comply with the specifications, and the fee will be computed on the basis of the number of items tested plus a special handling charge. Items 202.408 a to e inclusive will be applicable if a minimum of 12 chambers are submitted at one time; otherwise item 202.408z will be applicable. Only one letter reporting results of test will be supplied for any one test at the prices of items 202.408 a to e inclusive.

Item	Description	Fee
202.408a	Single Neubauer haemacytometer chamber—testing single cell chamber (having Neubauer ruling) and 2 cover glasses for conformity with specification	$7.00
202.408b	Single Fuchs-Rosenthal haemacytometer chamber—testing single cell chamber (having Fuchs-Rosenthal ruling) and 2 cover glasses for conformity with specification	10.00
202.408c	Double Neubauer haemacytometer chamber—testing double cell chamber (having 2 Neubauer rulings) and 2 cover glasses for conformity with specification	5.00
202.408d	Double Fuchs-Rosenthal haemacytometer chamber—testing double cell chamber (having 2 Fuchs-Rosenthal rulings) and 2 cover glasses for conformity with specification	20.00
202.408e	Quadruple haemacytometer chamber—testing quadruple cell chamber (having 2 Neubauer rulings and 2 Fuchs-Rosenthal rulings) and 2 cover glasses for conformity with specification	21.00
202.408z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.409 Areas and area-measuring instruments.

Item	Description	Fee
202.409z	Special tests only are conducted in this category and fees will be charged dependent upon the nature of the test.	

§ 202.410 Precision circles.

Item	Description	Fee
202.410z	Special tests only are conducted in this field and fees will be charged dependent upon the nature of the test.	

§ 202.411 Linear thermal expansion of solids.

Item	Description	Fee
202.411z	Special tests only are conducted in this category and fees for accepted tests will be charged dependent upon their nature. Only those tests that cannot be carried out elsewhere may be accepted.	

§ 202.412 Gage blocks.

(a) Test fee schedules in § 202.412 include a statement of the accuracy to which measurements are ordinarily made; however, if the character of the defining surfaces of a gage block is not such as to warrant this accuracy, the report will show the accuracy actually obtained. All gage blocks submitted for test should be in substantially new block condition and each block should be marked with an identification number.

(b) In the shipment of gage blocks extreme precaution should be taken both against corrosion and damage by contact with other gage blocks during transit. All defining steel surfaces should be greased and the blocks padded with waxed paper or volatile rust inhibitor treated paper. A greased steel surface coming in contact with newspaper, wrapping paper (unwaxed) or excelsior is very likely to corrode. Sets of gage blocks should have packing inside the case, and the case should be bound shut as the clasps frequently open or break during shipment.

(c) Shipments and purchase orders should be sent to the National Bureau of Standards, Washington 25, D.C., marked to the attention of the Length Section.

Item	Description	Fee
202.412a	Gage blocks—determination of length to ±0.000004" and excessive errors in flatness and parallelism, for sizes from 0.100" to and including 1.000" in lots of 10 or more, each. Actual cost of calibration will be charged for smaller lots.	$57.00
202.412b	Gage blocks—determination of length to ±0.000005", ±0.000006", and ±0.000007", respectively, for blocks from 1" to 2", 2" to 3", and 3" to 4", in length and excessive errors in flatness and parallelism, in lots of 3 or more, each. Actual cost of calibration will be charged for smaller lots.	21.00
202.412ab	Measurements as described under items (a) and (b) for usual 81 block set, per set. Extra blocks will be charged for under item (a) or (e).	525.00
202.412c	Gage blocks—determination of length to ±0.000002" and excessive errors in flatness and parallelism, for sizes from 0.100" to and including 1.000", in lots of 10 or more, each. Actual cost of calibration will be charged for smaller lots.	11.00
202.412d	Gage blocks—determination of length to ±0.000002", ±0.000003", and ±0.000004", respectively, for blocks from 1" to 2", 2" to 3", and 3" to 4", in length and excessive errors in flatness and parallelism, in lots of 3 or more, each. Actual cost of calibration will be charged for smaller lots.	32.00
202.412cd	Measurements as described under items (c) and (d) for usual 81 block set, per set. Extra blocks will be charged for under item (c) or (e).	880.00
202.412e	Gage blocks—determination of length to ±0.000003" and excessive errors in flatness and parallelism, for sizes from 0.010" to and including 0.090", in lots of 10 or more, each. Blocks in this size range are usually warped and do not warrant calibration to a higher accuracy. In special cases blocks 0.040" and thicker will be calibrated under item (c) if the errors in flatness of the blocks are not excessive.	9.00
202.412f	Gage blocks—determination of length to ±0.000001" per inch of length and excessive errors in flatness and parallelism, for blocks of the following length: 5, 6, 7, 8, 10, 12, 16, and 20", in lots of 3 or more, each. Actual cost of calibration will be charged for smaller lots.	80.00
202.412z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

Engineering Metrology

§ 202.500 General.

(a) Test fee schedules 202.501 to 202.509 include a statement of the relative accuracy to which measurements are ordinarily made. However, if the character of the defining surface of a gage or other article is not such as to warrant the measurement to this ac-

curacy, the report will show the accuracy actually obtained. If a greater accuracy is requested and the defining surfaces are such as to permit measurements to the accuracy requested, the necessary measurements will be made and a special fee will be charged.

(b) In addition to the items covered by schedules 202.501 to 202.509 other items such as gage block accessories, taper plug and ring gages, and gill net gages are occasionally calibrated. Other sizes than those listed in the fee schedules are also calibrated on special request. These tests and calibrations are made so infrequently that it is not practical to list a definite fee, and such work will be done on the basis of the cost of the work.

(c) In the shipment of gages, extreme precautions should be taken both against corrosion and damage by contact with other gages during transit. All defining steel surfaces should be greased and protected with waxed paper or a suitable strippable plastic coating. A greased steel surface coming in contact with newspaper, wrapping paper (unwaxed) or excelsior is very likely to corrode. Small gages suitably wrapped may be fastened in place in a strong rigid container so that no movement is possible. Plug and ring gages should ordinarily not be shipped mated. In the case of large-size threaded plugs and rings, mating is permissible as a means of protecting the plug threads. In such cases a grease must be used that will prevent electrolytic corrosion between the mating gages.

(d) Minimum test fee for calibration work is $20.00.

§ 202.501 End standards of length.

Item	Description	Fee
	End standards with spherical or pointed ends, or flat ends with area of contact less than ¼ square inch:	
202.501a	End standards—determination of length to ±0.00005" for lengths up to and including 8", each	$12.00
202.501b	End standards—determination of length to ±0.000005" per inch of length for lengths over 8" up to and including 20", each	16.00
202.501c	End standards—determination of length to ±0.000005" per inch of length for lengths over 20" up to and including 40", each	20.00
202.501d	End standards—determination of length to ±0.000005" per inch of length for lengths over 40" up to and including 72", each	24.00
202.501e	End standards—determination of length to ±0.00002" for lengths up to and including 8", each	24.00
202.501f	End standards—determination of length to ±0.000003" per inch of length for lengths over 8" up to and including 20", each	32.00
202.501g	End standards—determination of length to ±0.000003" per inch of length for lengths over 20" up to and including 40", each	40.00
202.501h	End standards—determination of length to ±0.000003" per inch of length for lengths over 40" up to and including 72", each	45.00
202.502z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.502 Plain cylindrical plug and ring gages.

Item	Description	Fee
202.502a	Plain cylindrical plug gages—determination of diameter, taper, and roundness to ±0.00005" for sizes up to and including 4", each	$12.00
202.502b	Plain cylindrical plug gages—determination of diamter, taper, and roundness to ±0.00001" for sizes up to and including 2", each	35.00
202.502c	Plain cylindrical plug gages—determination of diameter, taper, and roundness to ±0.000005" for sizes up to and including 2", each	50.00
202.502d	Plain cylindrical ring gages—determination of diameter, taper, and roundness to ±0.00001" for sizes .03" up to and including 2", each	50.00
202.502e	Plain cylindrical ring gages—determination of diameter, taper, and roundness to ±0.000005" for sizes .03" up to and including 2", each	75.00
202.502f	Plain cylindrical ring gages—determination of diameter, taper, and roundness to ±0.000003" for sizes .25" up to and including 2", each	100.00
202.502z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.503 Thread plug and ring gages.

Item	Description	Fee
202.503a	Straight thread plug gages and setting thread plug gages—determination of angle to 3' to 15' depending on pitch and diameter; lead error and pitch diameter to 0.0001", major diameter to 0.0002", thread form as to clearance, for sizes ¼" to 6" each	$30.00
202.503b	Straight thread ring gages—determination of angle to 3' to 15' depending on pitch and diameter, lead error to 0.0001", minor diameter to 0.0002", thread form as to clearance, and fit on setting plug, for sizes ¼" to 6", each	90.00
202.503c	Taper thread plug gages having 60° threads (except API Cable and Rotary gages)—determination of half angles to 3' to 15' depending on pitch and diameter, lead error, pitch diameter and taper to 0.0001", major diameter to 0.0003", and thread form as to clearance, for sizes up to and including 10", each	75.00
202.503d	Taper thread plug gages having 60° threads—determination of half angles to 3' to 15' depending on pitch and diameter, lead error and taper to 0.0001", pitch diameter to 0.0002", major diameter to 0.0004", and thread form as to clearance, for sizes over 10" to 24", inclusive, each	95.00
202.503e	Taper thread ring gages having 60° threads (except API Cable and Rotary gages)—determination of angle to 3' to 15' depending on pitch and diameter, lead error to 0.0001", taper to 0.0002", minor diameter to 0.0005" (or truncation of thread crest), threadform as to clearance, and standoff from mating plug to 0.002" for sizes up to 10", each	60.00
202.503f	Taper thread ring gages having 60° threads—determination of angle to 3' to 15' depending on pitch and diameter, lead error to 0.0001", taper to 0.0002", minor diameter to 0.0005" (or truncation of thread crest), thread form as to clearance, and standoff from mating plug to 0.002", for sizes over 10" to 24" inclusive, each	95.00
202.503g	API Cable and Rotary taper thread plug gages—determination of dimensions specified in API Standard 7, each	110.00
202.503h	API Cable and Rotary taper thread ring gages—determination of dimensions specified in API Standard 7, each	$75.00
202.503i	API Cable and Rotary tool connection gages—determination of mating standoff and standoff from grand master gages, per set	30.00
202.503j	API sucker rod plug gages designated as P1, P5, P7, B2 and B6—determination of dimensions specified in API Standard 11B, each	30.00
202.503k	API sucker rod plug gages designated as P3 and B4—determination of dimensions specified in API Standard 11B, each	60.00
202.503l	API sucker rod ring gages designated as P2, P6, P8, B1 and B5—determination of dimensions specified in API Standard 11B, each	30.00
202.503m	API sucker rod ring gages designated as P4 and B3—determination of dimensions specified in API Standard 11B, each	50.00
202.503n	API sucker rod gages—determination of dimensions specified in API Standard 11B for the inspection of used gages, per set of any size	140.00
202.503o	API Buttress Casing Plug Gages—determination of dimensions specified in API Standard 5B for sizes up to 10", each	85.00
202.503p	API Buttress Casing Plug Gages—determination of dimensions specified in API Standard 5B, for sizes over 10", each	105.00
202.503q	API Buttress Casing Ring Gages—determination of dimensions specified in API Standard 5B, for sizes up to 10", each	70.00
202.503r	API Buttress Casing Ring Gages—determination of dimensions specified in API Standard 5B, for sizes over 10", each	95.00
202.503z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.504 Instruments and components.

Item	Description	Fee
202.504a	Micrometer calipers—determination of errors at 10 points selected to test uniformity of graduations as well as lead errors. Also determination of planeness and parallellism errors of contact surfaces, each	$50.00
202.504b	Dial micrometers—determination of errors in each 1/10th revolution of the pointer for 1 revolution and each half revolution up to 5 revolutions, each	35.00
	NOTE: In the case of dial micrometers, the accuracy obtainable depends on the value of the smallest division on the dial and on the mechanical condition of the instrument as evidenced by the degree to which it will repeat its indications.	
202.504c	Thread wires—determination of diameter, straightness, and roundness of each of three wires in a set in accordance with specification for wires in Handbook H28, Screw Thread Standards for Federal Services, and determination of mean diameter and C correction, for the best sizes of wires for standard 60° screw threads, from 2 to 80 threads per inch and for 29° Acme screw threads from 1 to 20 threads per inch, per set of 3 wires	6.00
202.504d	Gear wires—determination of diameter, straightness, and roundness of each of 2 wires in a set to an accuracy of ±0.000010", per set	6.00
202.504e	Master wires—determination of mean diameter, and straightness to an accuracy of ±0.000005", each	15.00

Item	Description	Fee
202.504f	Penetration needles—test for compliance with ASTM specification D5–52 without reporting actual dimensions, each	$3.00
202.504g	Penetration needles—test for compliance with ASTM specification D5–61 with dimensions reported, each NOTE: Request quotation on test of 6 or more needles on above test.	25.00
202.504h	Petroleum wax penetration needles—test for compliance with ASTM Specification D1321–61T, without reporting dimensions, each NOTE: Penetration needles must be serial numbered, otherwise, needles will be numbered by NBS, each	5.00 2.00
202.504i	Polariscope tubes—determination of the average length of polariscope observation tube and marking with NBS serial number if length is within ±0.03 mm of nominal length for 100 and 200 mm tubes and ±0.04 mm for 400 mm tubes, each	24.00
202.504z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.505 Optical reference planes.

Item	Description	Fee
	Optical reference planes are tested interferometrically, horizontally supported with test surface supported on three equally spaced pads located at 0.7 of the radius from the center. The test is performed along two marked diameters at 90° to each other on each surface, when each diameter is parallel to two of the support pads. Graphs of the profiles are supplied.	
202.505a	Optical reference plane—to an accuracy of ±0.0000005" for sizes not exceeding 6", per surface	$70.00
202.505b	Optical reference plane—to an accuracy of ±0.0000005" for sizes larger than 6" but not exceeding 8" in diameter, per surface	100.00
202.505c	Optical reference plane—to an accuracy of ±0.0000005" for sizes larger than 8" but not exceeding 10" in diameter, per surface	150.00
202.505d	Optical true plane not exceeding 3" in diameter—measured along 4 marked diameters at 45° to each other, to an accuracy of ±0.0000002". Test performed by intercomparison of a group of three similar planes supplied by customer. Total of 12 diameters—4 each on one surface of 3 planes	500.00
202.505z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.506 Angle blocks.

Item	Description	Fee
202.506a	Calibration of set of AA grade angle blocks consisting of one each of the following sizes: 1, 3, 5, 20, and 30 seconds; 1, 3, 5, 20, and 30 minutes; 1, 3, 5, 15, 30, and 45 degrees—determination of flatness of faces, parallelism of elements of surfaces and angle between faces. Accuracy of angle between faces 0.5 second. Per set	$350.00
202.506z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.507 Polygons.

Item	Description	Fee
	Calibration of polygons—determination of flatness of faces, variation of the angles between faces and the base of the polygon (where possible the polygon will be adjusted for minimum variation) and the angle between faces. Accuracy of values for angles between faces 0.5 second or less:	
202.507a	Polygons having 4 or 5 sides, each	$175.00
202.507b	Polygons having 8, 9, or 10 sides, each	200.00
202.507c	Polygons having 12 sides, each	250.00
202.507d	Polygons having 24 sides, each	400.00
202.507e	Polygons having 36 sides, each	800.00
202.507f	Polygons having 72 sides, each	2,000.00
202.507z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.508 Master balls.

Item	Description	Fee
202.508a	Steel or Carbide balls—determination of diameter to ±0.000050" for sizes from 1/16" to 1", each	$10.00
202.508b	Steel or Carbide balls—determination of diameter to ±0.000010" for sizes from 1/16" to 1", each	15.00
202.508c	Master ball—determination of diameter to ±0.000005" by comparison with NBS master and measurement of roundness of two equators, for sizes from 1/2" to 1/2" by 1/32" steps and 1/2" to 1" by 1/16" steps. Test applied only on balls with diameter variation of 0.000005" or less and deviation from nominal size within ±0.000030", each	25.00
202.508d	Master balls—determination of mean diameter from 5 interferometric readings to an accuracy of ±0.000003" and measurement of roundness of four equators. For sizes up to 1" in diameter. Test made only on balls with diameter variation of 0.000003" or less, each	60.00
202.508z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 202.509 Gears.

Item	Description	Fee
202.509a	Tooth Index Measurement—Calibration results recorded in tape form with each tooth location being represented by a plateau and another tape (taken simultaneously) of the reference diameter location during the tooth index calibration. Gears, master gears, gear cutters, and index plates, from 0.125" diameter to about 8.0" diameter and from about 24 teeth to about 500 teeth. The maximum overall length of the part must be less than 3". Suitable reference and calibration surfaces must be available to obtain the estimated accuracy of ±3 seconds of arc.	
	For 71 teeth or less, each	$160.00
	For 72 teeth or more, each	200.00
	NOTE: The cost of any needed adaptors will be added to the calibration cost, if made by NBS.	
202.509z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

MASS AND VOLUME

§ 202.610 General.

(a) *Calibration and testing.* (1) Calibration consists of determining the value, either mass or volume, relative to an accepted standard. It is assumed that all items submitted for calibration will be used as reference standards. (This designation implies the use of a correction or actual value of the standard in all measurements relative to it.) Results of a calibration will be reported in a National Bureau of Standards "Report of Calibration" listing the value together with an appropriate uncertainty. The Report of Calibration makes no reference to the compliance with existing Class tolerances which limit the departure of actual value from the nominal value.

(2) Testing consists of establishing compliance with applicable specifications or tolerances. If the need is critical and the service is not available elsewhere, items may be accepted for test. The results of the test will be reported in a National Bureau of Standards "Report of Test" which generally is a statement indicating the compliance, or non-compliance, with the particular specification or tolerance.

(3) Acceptance for calibration or test is based on inspection at the National Bureau of Standards. Acceptance is based on suitability for use as a reference standard. Items not accepted for calibration or test will be returned, the appropriate cleaning, handling and inspection fee being applicable.

(4) The established fees are based on satisfactory test or calibration effected by normal procedures. Total cost of test or calibration will include cost of items required to facilitate the use of normal procedures. Examples of items, the cost of which will be added to the established fees as routine procedure are: replacement of missing small weights, repairs to damaged surfaces, the cleaning and greasing of glass stop cocks, repairs to shipping cases or crates, and the reconditioning or modification of closures for weight-adjustment cavities.

(5) Occasionally items are received for test which vary excessively from nominal. Such variation becomes evident in the actual calibration or test. Completion of calibration or test may require considerable deviation from normal procedures. For such cases, the fee will be computed on a cost basis.

(6) When requested, receipt of items and purchase orders will be acknowledged. Such acknowledgment will not contain a price quotation. Actual cost of the calibration or test will be stated in the acknowledgment copy of NBS Form 64. Usually, this acknowledgment is issued sufficiently in advance of the completion of the work so that change orders can be processed prior to return shipment.

(b) *Correspondence and purchase orders.* (1) All correspondence concerning calibration and testing, should

be addressed to the National Bureau of Standards, Attention: Mass and Volume Section, 2.06, Washington 25, D.C.

(2) The purchase order or calibration request must include the following items:

(i) Purchase order number or authority to charge against existing open purchase order.

(ii) Legal owner of item.

(iii) Nominal designation and total number of items by count.

(iv) Shipping instructions for shipment to other than name stated in (i).

(v) Previous Bureau of Standards Test Number if appropriate.

(3) After completion of calibration or test, items will be packed and shipped as directed. The Report of Calibration or the Report of Test, whichever is applicable, will be mailed under separate cover.

§ 202.611 Reference standards of mass.

(a) Reference standards of mass are weights or weight sets of design, material and surface finish comparable to, but not necessarily limited to present Class A, B, M, S or S–1 as described in Circulars 3 and 547 in Volume 3 of NBS Handbook 77. Standards accepted are calibrated with reference to NBS standards of mass, with an uncertainty compatible with the equipment and methods used.

(b) Packing and shipping: (1) Weights must be carefully packed. If shipped in their regular cases the weights should be tightly packed in their pockets by the use of extra material of some sort.

(2) In many instances the sheet-metal weights that are packed under the glass covers of the regular cases reach the Bureau bent or otherwise damaged. Care should be given the packing of these weights. Sufficient extra packing should be used to hold the glass cover firmly in place.

(3) Many of the laboratory and storage weight cases now in service are not designed to retain the weights in the pockets during shipment. Also, shipments of weights are sometimes subjected to exceptionally rough handling. It is strongly recommended that weights larger than about 200 g be removed from the laboratory or storage cases and packed for shipment as described in this section. Do not ship empty storage cases.

(4) Some soft but firm material should be used next to the weight and bound tightly against it to avoid possibility of abrasion. If tissue paper is used, many thicknesses should be firmly wrapped on. This should then be covered with thicker, tougher material such as cotton gauze or knit goods. The whole should then be wrapped securely in heavy wrapping paper to exclude the dust and grit from rough packing material. Each package should be clearly labeled.

(5) Weight identification, purchase order number, and legal owner must be clearly designated on the packing slip. Enclose packing slip in envelope and attach to outside of box (wrap with weights if package is small). Envelope should be clearly marked. Also package with the weights an information sheet stating the density and composition or accepted trade name of the material of which the weights are made, also the construction and surface protection of the weights.

(c) Calibration: (1) Cleaning, inspection and handling in accordance with fee 202.611 (a through d) will apply to all weights accepted for calibration.

(2) The true mass and/or apparent mass corrections are determined using computed volumes based on the manufacturers statement of density of the material. (In the absence of this information, estimated densities are used.) The apparent mass correction at 20° C. is computed with reference to Normal Brass (density 8.4 g/cm³ at 0° C.: Volume coefficient expansion 0.000054/C.°, air density 1.2 mg/cm³). Apparent mass corrections computed to any other basis will be furnished if requested. Fee in accordance with 202.611 (e through z) will apply for calibration.

(3) Measurement of volumes for use in computing corrections will be done on a cost basis (202.611z). Correspondence or consultation as to the exact requirements must provide a basis for such calibration.

Item	Description	Fee
	INSPECTION, CLEANING AND HANDLING (ALSO APPLIES TO WEIGHTS NOT ACCEPTED FOR CALIBRATION)	
202.611a	For single weight not greater than 50 pounds or 20 kg	$12.00
202.611b	For each set or group of weights submitted as a unit, when the largest weight is not greater than 2 pounds or 1 kg	17.00
202.611c	For each set or group of weights submitted as a unit, when the largest weight is not greater than 20 pounds or 10 kg but is greater than 2 pounds or 1 kg	25.00
202.611d	For each set or group of weights submitted as a unit when the largest weight is not greater than 50 pounds but is greater than 20 pounds or 10 kg	35.00
	FOR CALIBRATION, IN ADDITION TO APPROPRIATE INSPECTION, CLEANING AND HANDLING FEES	
202.611e	For sets 100 g to 1 mg, or sets within this range, calibration	140.00
202.611f	For sets 100 g to 50 mg, or sets within this range, calibration	120.00
202.611g	For sets 100 g to 1 g, or sets within this range, calibration	60.00
202.611h	For sets 1 g to 1 mg, or sets within this range, calibration	80.00
202.611i	For individual weights, 100 g or less, calibration	10.00
202.611j	For each individual weight greater than 100 g but not greater than 2 kg, calibration	15.00
202.611k	For each individual weight greater than 2 kg but not greater than 20 kg	50.00
202.611z	Other operations will be charged for on the basis of actual cost of time and materials.	

§ 202.612 Large mass standards.

(a) Large mass reference standards are weights over 50 pounds (up to and including 10,000 pounds). Acceptance for calibration is based on suitability with regard to general design and upon assurance of usage as a reference standard.

(b) Weights over 50 pounds will be accepted for testing or standardization provided the need is critical and the service is not available elsewhere. (Testing is to determine compliance or noncompliance with accepted specifications. Standardization includes testing and adjustment to comply with appropriate adjustment tolerance.)

(c) Packing and shipping: (1) Arrangements for testing or calibration should be completed before weights are shipped to the National Bureau of Standards. All correspondence must be addressed to the National Bureau of Standards, Washington 25, D.C.

(2) Weights from 51 pounds to approximately 250 pounds must be clean, suitably protected and shipped in wooden boxes having screw-fastened covers. Larger weights must be clean, suitably protected and shipped in reusable crates. Adjustment cavity seals must be packed separately and included with all new weights shipped to NBS for standardization. The empty adjustment cavities must be suitably protected to exclude dirt and moisture while in transit.

(3) Ship weights as follows:

(i) Test weights of 50 pounds and reference standards of 51 to 1,000 pounds: From the West Coast and the Rocky Mountain area, ship to the National Bureau of Standards, Boulder, Colorado; from the Midwest, ship to the National Bureau of Standards Master Scale Depot, 5800 West 69th Street, Chicago, Illinois; from the East, ship to the National Bureau of Standards, Connecticut Avenue and Van Ness Street NW., Washington 25, D.C.

(ii) 1001 to 10,000 pounds: It is desirable that weights larger than 1000 pounds be submitted to the National Bureau of Standards Master Scale Depot, 5800 West 69th Street, Chicago, Illinois; however, by previous correspondence, arrangements can be made for accepting such weights at the National Bureau of Standards in Washington, D.C.

(d) Adjusting material: When large amounts of adjusting material are required for new weights, the Bureau reserves the right to add the cost to the test fee or to require the owner or maker to furnish the material.

(e) Calibration, test and standardization: For a calibration, the value of the weight or object (apparent mass with reference to Normal Brass) together with a statement of uncertainty will be reported on an NBS Report of Calibration. Weights accepted for test will be reported as either complying or not complying with appropriate specifications on an NBS Report of Test. Weights accepted for standardization will be reported as complying with appropriate adjustment tolerance specifications on an NBS Report of Test. Fees in accordance with 202.612 (a thru z) apply.

Item	Description	Fee
	TEST WEIGHTS, 50 LB, CLASS C, CAST IRON	
202.612a	A handling fee of $2.25 per weight in addition to the applicable test fee will be charged for each weight of a group submitted the minimum handling charge shall be	$12.00
	(NOTE: The National Bureau of Standards no longer tests weights of this kind on a routine basis. Special need or requirement for this work must be established.)	
202.612b	Tolerance testing (no adjustment) per weight	8.00
202.612c	Standardization, per weight	16.00

Item	Description	Fee
	TEST WEIGHTS 51 TO 1,000 POUNDS	
202.612d	Test and when adjustable, standardize within Class C adjustment tolerances	$25.00
202.612e	Calibrate only (precision 1/100,000)	20.00
	TEST WEIGHTS 1,001 TO 2,500 POUNDS	
202.612f	Test and, when adjustable, standardize to nominal value with precision of 0.01 pound	35.00
202.612g	Calibrate only (precision 1/100,000)	30.00
	TEST WEIGHTS, 2,501 TO 10,000 POUNDS	
202.612h	Calibration only (precision 1/25,000)	35.00
202.612i	Calibration only (precision 1/100,000)	42.00
202.612j	Standardization, in addition to either 202.612h or 202.612i	25.00
	CARS, RAILWAY TRACK SCALE TEST	
202.612k	Standardization on Master Track Scale at National Bureau of Standards Master Scale Depot, 5800 West 69th Street, Chicago, Illinois	40.00
	TEST WEIGHTS, 10,000 TO 150,000 POUNDS	
202.612s	Fees for tests of weights in this grouping will be charged dependent upon the nature of the test.	

§ 202.613 Calibration of mass elements of pressure gage testing apparatus.

Calibration consists of cleaning, marking with suitable designation when required, and determining the value, which for weights of one pound and greater is reported to a precision of 1 part in 100,000. The fee is in accordance with Fee Schedule Item 212.613a.

Item	Description	Fee
212.613a	Each item to be calibrated	$6.00

§ 202.614 Recalibration of mass standards.

(a) Recalibration of reference mass standards should be based on monitoring the difference between weights or groups of weights in the set. As long as the differences as measured agree with the computed differences, the set can be considered constant. Mass standards submitted for recalibration will be cleaned, inspected and tested by intercomparison. If this intercomparison shows there has not been a sufficient change to warrant complete recalibration, a letter so stating and referring to the previous National Bureau of Standards Report of Calibration will be issued. Such a letter may include new values for one or two weights if necessary. Fee will not exceed that listed under §§ 202.611, 202.612 or 202.613, whichever is applicable.

§ 202.615 Glass volumetric apparatus.

(a) Glass volumetric apparatus is tested generally by weighing the amount of distilled water contained or delivered with reference to the graduations marked on the instrument. The quality of the markings and the care exercised in reading or setting the liquid level are major factors in both calibration and usage. Occasionally such instruments are used as reference or transfer standards which require calibration. Many usage requirements are satisfied by testing for compliance with existing capacity tolerance specifications. The Mass and Volume Section offers both calibration and testing, subject to certain restrictions.

(b) Instruments suitable for, and to be used for, reference or transfer standards will be accepted for calibration. Such instruments must essentially conform to the specifications contained in NBS Circular 602, Testing of Glass Volumetric Apparatus. Acceptance for calibration is based on correspondence or consultation concerning the exact manner in which the instrument is to be used. If accepted for calibration, the instrument will be marked with an identification number, calibrated, and the results reported on an NBS "Report of Calibration". The report will state the capacity under the conditions of test together with an associated statement concerning uncertainty. Fee for calibration will be computed on a cost basis.

(c) Precision grade glass volumetric apparatus will be accepted for testing to determine compliance with specifications and tolerances if the need is critical and the service is not available elsewhere. Acceptance for test is based on conformance with the specifications contained in NBS Circular 602, or other appropriate specifications. The item will be marked with an appropriate stamp if test results indicate conformity with NBS approved specifications and tolerances. No individual report will be issued (see d below for exception). Fee for testing is in accordance with 202.615 (a through k).

(d) A report will be furnished listing the test results for groups of blood pipettes to be used as factory standards, if requested. Fees in accordance with 202.615o.

Item	Description	Fee
	Testing in accordance with specifications in NBS Circular 602 or other approved specifications.	
202.615a	Flasks of capacities up to and including 250 ml, each	$3.50
202.615b	Flasks of capacities exceeding 250 ml, each	4.50
202.615c	Flasks marked both to "to contain" and "to deliver," each	6.50
202.615d	Flasks, of any capacity, when bearing more than one graduation mark. Primary capacity, each	4.00
202.615e	Each capacity in addition to primary (number determined by NBS)	1.75
202.615f	Flasks, specific gravity, each	8.50
202.615g	Cylindrical graduates, capacities up to and including 250 ml, each	10.00
202.615h	Cylindrical graduates, capacities exceeding 250 ml, each	12.00
202.615i	Transfer pipettes, each	3.00
202.615j	Burettes, except automatic, each	12.00
202.615k	Burettes, automatic, each	14.00
202.615l	Measuring pipettes, each	9.00
202.615m	Apparatus a through k disqualified for test on initial inspection per item	3.00
202.615n	Dilution pipette, including Trenner automatic and Sahli, each	1.00
202.615o	Dilution pipettes, automatic, other than Trenner, each	5.00
202.615p	Report of test for quality control purposes, each item (applies to 202.615 n and o only)	1.00
202.615q	Apparatus n and o disqualified for test on initial inspection, each	$1.00
202.615r	Items except those above for which there are accepted specifications, such as microazotometers, spirits measuring flasks, etc., will be tested on a cost basis in accordance with 202.615z. (Report of test will include capacities at test points if appropriate.)	
202.615z	For special calibrations not covered by above schedules fee will be determined on a cost basis.	

§ 202.616 Metal volumetric apparatus.

(a) Only those instruments suitable for use as reference standards (see, for example, specifications contained in National Bureau of Standards Monograph 62, Testing of Metal Volumetric Standards) will be accepted for calibration, based on inspection at the National Bureau of Standards. Calibration consists of determining the value "to contain" or "to deliver" by either gravimetric means or by the use of transfer standards. The item will be marked, and the value determined will be reported, together with a statement concerning the uncertainty, on a National Bureau of Standards Report of Calibration. Fee in accordance with 202.616 (a through z) applies. Specify "to contain", "to deliver" or both.

(b) Items not accepted for calibration as a result of initial inspection will be returned, fee in accordance with 202.616o being applicable.

(c) Packing and shipping:

(1) The apparatus should be securely packed in cases or packages which will protect against possible damage.

(2) When submitting immersion bottles for calibration, do not include the tank as it is not used in the calibration.

(3) Arrangements for calibration of Field Standards in excess of 10 gallons capacity must be completed before shipping apparatus to the National Bureau of Standards.

(4) If requested, the zero index or gage scales on Field Standards will be adjusted and sealed to within accepted tolerance specifications. Adjustment of slicker plate type standards should be made by the manufacturer.

Item	Description	Fee
	CALIBRATION "TO CONTAIN". FEE FOR CALIBRATION "TO DELIVER" IS SAME. FOR BOTH CALIBRATIONS, DOUBLE FEE SHOWN	
202.616a	Slicker plate measures of capacity less than 5 gallons, each	$19.00
202.616b	Slicker plate measures of 5 gallon capacity, each Note: Adjustments of slicker plate measures to within accepted capacity tolerances, if requested, are done on a cost basis under 202.616z.	25.00
202.616c	1/10 cubic foot bottles for use in testing gas meters, each	25.00
202.616d	Cubic foot bottles for use in testing gas meters, each	41.00
202.616e	Portable cubic foot standards (Stillman type)	135.00
202.616f	Field standards of capacity less than 5 gallons (graduated neck type), each	19.00
202.616g	Field standards of 5 gallons capacity, each	25.00

Item	Description	Fee
	FIELD STANDARDS IN EXCESS OF 5 GALLONS BUT LESS THAN 50 GALLON CAPACITY	
202.616h	First 10 gallons increment	$25.00
202.616i	Each additional 5 gallon increment	4.50
	FIELD STANDARDS OF 50 GALLONS OR MORE CAPACITY	
202.616j	First 50 gallon increment	43.00
202.616k	Each additional 50 gallon increment	7.50
202.616l	Each additional 5 gallon increment	4.50
202.616m	Calibration of field standards, graduated neck type, at more than one scale point, each additional point	15.00
202.616n	Adjustment of zero index on gage (graduated neck type), each	13.00
202.616o	Apparatus disqualified for test, inspection and handling fee, each	7.00
202.616z	For calibration not covered by the above schedule, fees will be charged on a cost basis.	

§ 202.617 Hydrometers.

(a) Hydrometers are considered reference standards. Those instruments conforming with the recommendations on construction contained in National Bureau of Standards Circular 555, Testing of Hydrometers, will be accepted for calibration, acceptance based on inspection at the National Bureau of Standards.

(b) For the purposes of this Fee Schedule, the following changes are made in Circular 555:

(1) Hydrometers with duplex scales or flat scales are not considered suitable for use as laboratory standards and will not be accepted for calibration.

(2) The thermometer element of a thermohydrometer will not be calibrated. (See A.S.T.M. specification E100, Standard Specification for A.S.T.M. Hydrometers.)

(3) The results of calibration will be furnished together with a statement of uncertainty, on a National Bureau of Standards Report of Calibration. Use as a laboratory standard implies the use of corrections, therefore no reference to tolerance compliances will be made on the report.

(c) Calibration consists of comparison at three or more points with a standard hydrometer. Fee in accordance with § 202.617 applies.

(d) Apparatus not accepted for calibration will be returned, appropriate inspection and handling fee being applicable. Each scale card must state the name of the manufacturer and his serial number, the standard temperature and type of scale.

Item	Description	Fee
202.617a	Hydrometers, calibrated at 3 points, lots of 10 or more of identical scale range and design, each	$13.00
202.617b	Hydrometers, calibrated at 3 points, lot of less than 10, each of identical range and design	16.00
202.617c	Calibration at additional points, each point	5.50
202.617d	Hydrometers disqualified for calibration, inspection and handling charge	5.00
202.617z	For special calibrations not covered by the above schedule, fees will be determined on a cost basis.	

§ 202.618 Density determinations of solids and liquids.

(a) If the need is critical and the service is not available elsewhere, request may be accepted for the following density determinations:

(1) Density of solids, determined by hydrostatic weighing in appropriate liquid. Solids generally to have a mass less than 175 g and a maximum dimension less than 15 cm.

(2) Density of liquids, determined by weighing in picnometers at temperatures between 0° and 70° C.

(3) Associated tests such as the volume of solids, coefficient of thermal expansion for both solids and liquids.

(b) Acceptance for test is based on consultation or correspondence regarding the exact nature of the requirements. Do not ship materials to the National Bureau of Standards until all arrangements for test have been completed. Fees for all tests are computed on a cost basis.

Item	Description	Fee
202.618z	Density determinations for solids and liquids, fees computed on a cost basis	

PART 203—HEAT

TEMPERATURE PHYSICS

Sec.
203.101 Laboratory thermometers.
203.102 Thermocouples, thermocouple materials, and pyrometer indicators.
203.103 Resistance thermometers.
203.104 Clinical thermometers.
203.105 Optical pyrometers and ribbon filament lamps.

AUTHORITY: §§ 203.101 to 203.105 issued under sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a.

TEMPERATURE PHYSICS

§ 203.101 Laboratory thermometers.

Only thermometers identified uniquely by serial number will be accepted for test.

Item	Description	Fee
203.101a	Thermometers, testing at points from 0 to 100° C. inclusive, or from 32 to 212° F. inclusive, for each point tested	$10.00
203.101b	Thermometers, testing at points from 101 to 300° C. inclusive, or from 213 to 600° F. inclusive, for each point tested	15.00
203.101c	Thermometers, testing at points from 301 to 500° C. inclusive, or from 601 to 950° F. inclusive, for each point tested	30.00
203.101d	Thermometers, testing at points from −1 to −110° C. inclusive, or from 31 to −166° F. inclusive, for each point tested	32.00
203.101e	Thermometers, testing in liquid air, oxygen, or liquid nitrogen (−183° to −196° C.), for each point tested	53.00
203.101f	Calorimeter thermometers	67.00
203.101g	Beckmann thermometers, with 5° or 6° scale, testing at 1° intervals by comparison with precision standards	73.00
203.101h	When instruments submitted are found to be unsuitable for test or unreliable a charge will be made to cover the cost of the work done. Minimum fee $1.00.	
203.101i	Preliminary examination for foreign material in the mercury column and bulb and for a separated mercury column will be made as required. Separated mercury column will be reunited provided this can be accomplished readily. Maximum fee $3.00.	
203.101z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 203.102 Thermocouples, thermocouple materials and pyrometer indicators.

(a) Only the bare wires are required in order to perform the thermocouple calibrations in this schedule. It is preferable not to send insulating and protecting tubes, as the rate of breakage of these in shipment is high. If the thermocouple is furnished mounted (as in a protection-tube assembly) a charge of $5.00 will be made for dismantling the mounting, and the various parts will be returned to the sender without reassembling them.

(b) Thermocouple length requirements listed below are exclusive of lead wire. Lead wire need not be sent with thermocouples.

(c) All thermocouple calibration data furnished in reports will be on the basis of a reference junction temperature of 0° C., or 32° F.

(d) The calibration or test of an article will not be undertaken if, in our opinion, the article will not yield the specified accuracy, or if it possesses such unusual characteristics as to prevent the carrying out of the calibration or test at a reasonable cost.

Item	Description	Fee
203.102a	High temperature thermocouples and thermocouple materials. Minimum length 24 inches. Corresponding values of temperature and emf of a thermocouple material against the platinum standards of the NBS or of temperature and emf of a thermocouple at any 4 to 15 points within the range 0° to 1450° C (32° to 2650° F)	$75.00
	The reported accuracy of calibration of platinum vs. platinum-rhodium thermocouples is 0.5 degree C from 0° to 1000° C and ranges from 0.5 degree at 1100° to 2 degrees at 1450° C. Results above 1100° C are obtained by extrapolation.	
	The reported accuracy of calibration of base-metal thermocouples is 1 degree C in the range 0 to 1100° C (32 to 2000° F). Base-metal thermocouples are not calibrated above 1100° C (2000° F).	
203.102b	High temperature thermocouples and thermocouple materials. Calibration as per item 203.102a at less than 4 points, per point	25.00
203.102c	Platinum vs. platinum-10% rhodium thermocouples. The thermocouple shall be at least 36 inches long and made of wire not less than 0.014 inch in diameter. Emf of a thermocouple at any of the following temperatures, per point	75.00
	1063° C (gold point), 960.5° C (silver point), 630.5° C (temperature of freezing antimony), 419.5° C (temperature of freezing zinc). Accuracy of calibration 2 microvolts (about 0.2 degree C).	

Item	Description	Fee
203.102d	Platinum vs. platinum-10% rhodium thermocouples. The thermocouple shall be at least 36 inches long and made of wire not less than 0.014 inch in diameter. Primary calibration at all of the temperatures listed in item 203.102c with accuracy of 2 microvolts, plus not more than 15 corresponding values of emf and temperature in the range 0° to 1450° C. The accuracy of calibration is 0.3 degree from 0° to 1100° C and decreases from 0.3 degree at 1100° C to 2 degrees at 1450° C. If the submitted thermocouple meets the International Temperature Scale requirements for standard thermocouples (see the International Practical Temperature Scale of 1948 by H. F. Stimson, J. Research NBS, 65A, 139, 1961), a quadratic equation fitted at 1063°, 960.8°, and 630.5° C will also be furnished	$255.00
203.102e	High temperature thermocouples and thermocouple materials. Interpolated corresponding values of emf and temperature as per item 203.102a or 203.102d, per point	2.00
203.102f	Base-metal thermocouples. Minimum length of 36 inches. Corresponding values of emf and temperature to an accuracy of 0.1° C in the range 0° to −110° C, per point	33.00
	Minimum calibration per thermocouple, 2 points.	
203.102g	Base-metal thermocouples. Minimum length of 36 inches. Corresponding values of emf and temperature to an accuracy of about 0.1° in the range 0° to 300° C and to an accuracy of about 0.2° above 300° C, per point	28.00
	Minimum calibration per thermocouple, 2 points.	
203.102h	Base-metal thermocouples. Minimum length of 36 inches. Corresponding values of emf and temperature to an accuracy of about 0.1° in the range −183 to −196° C, per point	46.00
	Minimum calibration per thermocouple, 2 points.	
203.102i	Pyrometer indicators. Calibration of single scale or meter of single dial of potentiometer (reference junction compensator counting as a dial)	23.00
203.102j	Pyrometer indicators. Calibration of each additional dial of a multi-dial instrument (reference junction compensator counting as a dial) or of each additional range of each dial or scale of a multi-range instrument	9.00
	Calibration of a thermocouple and pyrometer indicator as a unit will be charged for as if the thermocouple and indicator were separately calibrated.	
203.102z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 203.103 Resistance thermometers.

Resistance thermometers will normally be tested only if they may reasonably be expected to meet the requirements as a standard on the International Practical Temperature Scale. In general, this requires a 4-lead resistor of very pure platinum hermetically sealed in a protecting tube.

Item	Description	Fee
203.103a	Standard platinum resistance thermometers—calibration at the ice, steam and sulfur points. Table will be furnished with entries at 1-degree intervals	$165.00
203.103b	Standard platinum resistance thermometers—calibration under 203.103a and at the oxygen point. Table will be furnished with entries at 1-degree intervals	220.00
203.103c	Calorimetric type platinum resistance thermometers—calibration at the ice and steam points and at approximately 50° C. Table will be furnished with entries at 1-degree intervals	165.00
203.103d	Capsule-type platinum resistance thermometers—comparison calibration over the range from 12° to 90° K. Results will be in the form of a table with entries at 0.1 degree intervals. Additional tables are not available unless requested at the time of test. See item 203.103f	440.00
203.103e	Determination of the average temperature coefficient of electrical resistance over the interval 0° to 100° C. Minimum length, 16 inches. Samples must have a resistance of at least 0.1 ohm per foot at the ice point	70.00
203.103f	Each additional table expressing the results of test under items 203.103 a, b, or c	30.00
	Additional tables under item 203.103d are not available unless requested at the time of test.	
203.103g	Item 203.103f if requested at the same time as the test of the thermometer under items 203.103 a, b, c, or d	25.00
203.103h	Capsule-type platinum resistance thermometers—mounting this type of thermometer for test under item 203.103 a or b. Not applicable to item 203.103d	10.00
203.103y	When instruments submitted are found to be unsuitable for test or unreliable, a charge will be made to cover the cost of the work done.	
203.103z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 203.104 Clinical thermometers.

Item	Description	Fee
203.104z	Test of clinical thermometers for compliance with the current edition of the Commercial Standard for Clinical Thermometers. Fees will be charged dependent upon the time required for making the test.	

§ 203.105 Optical pyrometers and ribbon filament lamps.

(a) Optical pyrometers and ribbon filament lamps submitted for calibration should be accompanied by an order requesting the test and specifying the Fee Schedule Item Number. If desired, the calibration points may be specified. A bill will be rendered at the completion of the work.

(b) The calibration of an article will not be undertaken if it possesses such unusual characteristics as to prevent the carrying out of the calibration at a reasonable cost. If, in the course of a calibration the device is found to behave abnormally, work may be discontinued and a fee covering the cost of the work performed will be charged.

Item	Description	Fee
203.105a	Optical pyrometers: Calibration of one range between 800° C. and 2400° C. or the first range, between 800° C. and 2400° C. of a calibration involving more than one range; 4 to 12 values	$155.00
203.105b	Optical pyrometers: Calibration of ranges in addition to item 203.105a up to 4200° C.; 4 to 12 values in each range, per range	120.00
203.105c	Optical pyrometers: Three or fewer values, 800° C. to 2400° C.	95.00
203.105d	Ribbon filament lamps: Values of brightness temperature (at wavelength of 0.65 microns) versus direct current at 6 to 16 points in the range, 800° C. to 2300° C.	$165.00
203.105e	Ribbon filament lamps: Values of brightness temperature (at wavelength of 0.65 microns) versus direct current at 5 or fewer points in the range, 800° C. to 2300° C.	90.00
203.105f	Additional interpolated values as per item 203.105a and 203.105b, per point	2.25
203.105z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

PART 204—RADIATION PHYSICS

RADIOACTIVITY

Sec.

204.201 Calibration of gamma-emitting radioactive samples.
204.202 Calibration of alpha-emission rate of sources.
204.203 Calibration of beta-emitting radioactive samples.

RADIOLOGICAL EQUIPMENT—GAMMA-RAY SOURCES

204.501 X-ray and gamma-ray instruments.
204.502 Gamma-ray sources.

NEUTRON PHYSICS

204.701 Neutron sources.
204.702 Neutron instruments.
204.703 Neutron irradiation of foils.

AUTHORITY: §§ 204.201 to 204.703 issued under sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a.

RADIOACTIVITY

§ 204.201 Calibration of gamma-emitting radioactive samples.

Calibration of gamma-emitting radioactive samples that conform to the physical, chemical, and activity level specifications for measurement in the National Bureau of Standards gamma ionization chamber.

Item	Description	Fee
204.201a	(1) 100–300 micrograms of radium calibrated in terms of micrograms of radium-content measured relative to the National Radium Standard	$63.00
	(2) Chemically stable solutions of the following radionuclides in the specified activity ranges can be measured	55.00
	i. 50–100 microcuries of sodium–22, sodium–24, scandium–46, cobalt–60, yttrium–88.	
	ii. 150–300 microcuries of manganese–54, iron–59, strontium–85, niobium–95, iodine–131, cesium-barium–137, tantalum–182, gold–198, mercury–203.	
	iii. 300–600 microcuries of potassium–42, cobalt–57.	
	Solution should be 5 ml in volume and flame-sealed in a glass vial or ampoule of O.D. 16.0±0.5 mm, wall thickness approximately 0.5 mm.	
204.201b	Chemically stable solutions of the following radionuclides in the specified activity ranges can be measured	80.00
	i. 10–20 microcuries of sodium–22, sodium–24, scandium–46, cobalt–60, yttrium–88.	
	ii. 30–60 microcuries of manganese–54, iron–59, strontium–85, niobium–95, iodine–131, cesium-barium–137, tantalum–182, gold–198, mercury–203	
	iii. 60–100 microcuries of potassium–42, cobalt–57.	
	Solution should be 5 ml in volume and flame-sealed in a glass vial or ampoule of O.D. 16.0±0.5 mm, wall thickness approximately 0.5 mm.	

Item	Description	Fee
204.201z	For special tests not covered by the above schedule, advance arrangements must be made. Fees will be charged dependent on the time involved in making the tests.	

§ 204.202 Calibration of alpha emission rate of sources.

Item	Description	Fee
204.202a	Calibration of alpha emission rate of sources submitted for test	$51.00

§ 204.203 Calibration of beta-emitting radioactive samples.

Calibration of beta-emitting radioactive samples that conform to the physical, chemical, and activity level specifications for measurement in the National Bureau of Standards $2\pi\beta$-windowless proportional flow counter, or in the National Bureau of Standards $2\pi\beta$-ionization chamber.

Item	Description	Fee
204.203a	Chemically stable solutions of the following radionuclides in the specified activity ranges can be measured i. 0.5–2 microcuries/milliliter, strontium-yttrium-90. ii. 1–5 microcuries/milliliter, chlorine-36, thallium-204. iii. 3–10 microcuries/milliliter, sulfur-35, calcium-45, promethium-147. Solution should be approximately 5 ml in volume and flame-sealed in a glass vial or ampoule.	$155.00
204.203b	Chemically stable solutions of the following radionuclides in the specified activity ranges can be measured i. 0.3–3 microcuries/milliliter, phosphorus-32. Solution should be approximately 5 ml in volume and flame-sealed in a glass vial or ampoule.	90.00
204.203z	For special tests not covered by the above schedule, advance arrangements must be made. Fees will be charged dependent on the time involved in making the tests.	

RADIOLOGICAL EQUIPMENT—GAMMA-RAY SOURCES

§ 204.501 X-ray and gamma-ray instruments.

NOTE: Calibration of radiation beam within ±2 percent.

Item	Description	Fee
204.501a	Calibration of one X-ray exposure-indicating instrument of one range, in international roentgens for lightly or moderately filtered X-rays of one half-value layer from the following selections	$48.00

LIGHTLY FILTERED X-RAYS

Technique	kvcp	Approx. inherent filter (mm Be)	Added filter (mm Al)	Distance (cm)	Approx. first half-value layer (mm Al)	Homogeneity factor (1st HVL/2d HVL)	Instrument range from zero (R) min.	Instrument range from zero (R) max.	Exposure rate (R/min.) min.	Exposure rate (R/min.) max.
LFD	20	0.25	0	50	0.06	0.42	100	500	50	200
LFD	30	0.25	0	70	0.07		50	100	20	80
LFD	20	0.25	0	100	0.08		25	50	7	30
LFE	20	0.25	0.5	50	0.20	0.68	10	100	2	8
LFG	30	0.25	0.5	50	0.33	0.67	25	250	5	20
LFI	50	0.25	1.0	50	0.90	0.68	35	250	6	25
LFK	75	0.25	1.5	50	1.6	0.66	25	250	10	22
LFM	100	0.25	2.0	50	2.5	0.63	25	250	14	25

MODERATELY FILTERED X-RAYS

Technique	kvcp	Approx. inherent filter (mm Al)	Added filter mm Cu	Added filter mm Al	Approx. first half-value layer mm Cu	Approx. first half-value layer mm Al	Homogeneity factor (1st HVL/2d HVL)	Instrument range from zero (R) min.	Instrument range from zero (R) max.	Exposure rate (R/min.) min.	Exposure rate (R/min.) max.
MFB	50	1.5	0	0	------	1.64	0.67	5	100	0.4	3.0
MFC	60	1.5	0	2.5	0.09	2.79	0.77	5	100	0.4	2.5
MFE	75	1.5	0	2.5	0.11	3.41	0.73	5	100	0.4	4.0
MFG	100	1.5	0	3.5	0.20	5.05	0.73	5	100	0.9	6.0
MFI	150	1.5	0.25	3.5	0.66	10.1	0.87	5	100	1.0	8.0
MFK	200	1.5	0.5	3.5	1.25	13.2	0.92	10	250	2.0	13.0
MFM	250	1.5	1.0	3.5	2.17	16.2	0.94	10	250	2.5	17.0
MFO	250	1.5	3.2	3.5	3.20	18.4	0.96	10	250	1.3	10.0

Item	Description	Fee
204.501b	Calibration of each additional X-ray exposure-indicating instrument of the same range and for the same half-value layer of lightly or moderately filtered X-rays as selected under 204.501a and not requiring a change in setup and when the instruments are submitted at the same time	$18.00
204.501c	Calibration of one X-ray instrument, either exposure- or exposure-rate-indicating, in international roentgens for heavily filtered X-rays of one effective energy from the following selections	60.00

HEAVILY FILTERED X-RAYS [1]

Technique	kvcp	Approx. inherent filter (mm Al)	Added filter (mm) Pb	Sn	Cu	Al	Approximate Effective energy (kev)	HVL (mm Cu)	HVL (mm Al)	Instrument range from zero (R) min.	Instrument range from zero (R) max.	Exposure rate (R/min) min.	Exposure rate (R/min) max.
HFC	80	1.5	0.12	0	0	2.5	80	0.16	4.4	0.1	1	0.02	0.09
HFE	100	1.5	0.53	0	0	2.5	70	0.72	11.2	0.1	5	0.05	0.27
HFG	150	1.5	0	1.5	4.0	2.5	120	3.4	16.8	0.1	5	0.04	0.22
HFI	200	1.5	0.7	4.0	0.6	2.5	170	4.1	19.5	0.1	5	0.03	0.21
HFK	250	1.5	2.7	1.0	0.6	2.5	215	5.4	21.5	0.1	5	0.03	0.21

[1] Available on special arrangement.

Item	Description	Fee
204.501d	Calibration of each additional X-ray instrument of the same exposure or exposure-rate range, for heavily filtered X-rays of one effective energy as selected under 204.501c, not requiring a change in setup and when the instruments are submitted at the same time	$24.00

Item	Description	Fee
204.501e	Calibration of one instrument: (1) Exposure-rate-indicating instrument for exposure rates ranging from 0.01 to 15 R/minute; or (2) Exposure-indicating instrument of range 0.–0.1 R to 0.–25 R, in international roentgens for cobalt 60 or cesium 137 gamma rays	$42.00
204.501f	Calibration of each additional instrument having the same exposure or exposure-rate range for cobalt 60 or cesium 137 gamma rays, as under 204.501e, when the instruments are submitted at the same time	17.00
204.501z	Calibration of one X-ray or gamma-ray instrument, exposure- or exposure-rate-indicating, in international roentgens: (1) Calibration of higher accuracy than that routinely furnished; or (2) Calibrations on X-rays of energies other than those listed under 204.501a, c, or e; or (3) Calibrations requiring a special setup or special procedures. Fees will be charged dependent upon the nature of the test. NOTE: Only a limited number of special calibrations can be undertaken and requests for such should be submitted with full details for consideration.	

§ 204.502 Gamma-ray sources.

(a) Radioactive preparations submitted to the Bureau for test are subject to the following conditions:

(1) *Financial responsibility.* The Bureau assumes no responsibility for loss or damage to radioactive preparations while in its possession. The risk should be covered by insurance.

(2) *Period of measurement.* Approximately 10 days are required for measurement of these radioactive preparations.

(3) *Preparation of specimens.* Radioactive preparations submitted for test must be carefully sealed so that there can be no escape of any radioactive material including any gaseous decay products. The preparations, shielding and packaging must be free of contamination. Contaminated or leaking preparations cannot be measured and may cause considerable loss of time and damage to laboratory facilities. Preparations must have been sealed for a sufficient time to be substantially in radioactive equilibrium with their decay products when these contribute to the gamma emission. (At least 30 days for radium.)

(4) *Packaging for shipment.* Regulations of the Interstate Commerce Commission regarding the shipment of radioactive substances by rail must be complied with. These regulations are enforceable by law and prospective shippers of these substances need to be familiar with them. Copies of the regulations can be obtained from the Interstate Commerce Commission, Washington, D.C.

(5) *Possession of licensed material.* In submitting specimens of cobalt 60 or other licensed source material (except radium, which is not licensed) for calibration, it will necessary for the submitter to certify that he is duly authorized to possess the material under license by the USAEC, except in the case of individuals residing in a State which has entered into agreement with the USAEC, in which case State regulations are applicable. This certification may be by letter, by a suitable statement on the purchase order covering the calibration fee, or by a clear copy of the submitter's Possession License for the source material.

(6) *Type of measurements.* (i) Radium is calibrated in terms of milligrams of equivalent radium content measured relative to the National Radium Standard through comparison of the gamma radiation from the specimen and the standard. Where the details of encapsulation of the specimen are known, corrections can be made to obtain milligrams of radium content. Cobalt 60 is calibrated in terms of exposure rate, milliroentgens per hour at one meter, based upon comparison with derived standards of cobalt 60.

(ii) Postal regulations prohibit mailing radioactive materials which require a cautions label under ICC regulations. This effectively prohibits placing radioactive preparations in the mail.

Item	Description	Fee
	Gamma-ray measurements of radioactive preparations; measurements of milligrams equivalent content to ±0.7 percent for radium; and milliroentgens per hour at one meter to ±3 percent for cobalt 60:	
204.502a	0.5 to 15 mg (milligrams) equivalent radium content or cobalt 60 having gamma rays 0.5 to 15 mRhm (milliroentgens per hour at one meter)	$18.00
204.502b	15+ to 100 mg (milligrams) equivalent radium content or cobalt 60 having gamma rays 15+ to 100 mRhm (milliroentgens per hour at one meter)	28.00
204.502c	100+ to 250 mg (milligrams) equivalent radium content or cobalt 60 having gamma rays 100 to 200 mRhm (milliroentgens per hour at one meter)	40.00
204.502d	For measurements in groups not exceeding 10 preparations, double the fee for preparations of same content as the total content of the group.	
204.502e	For handling and examination of a shipment containing contaminated or leaking preparations the fee will be the same as for measurements of a preparation having a content equal to the total nominal radioactive content of the shipment.	
204.502z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test. As only a limited number of special tests can be carried out, prior arrangements must be made including submission of full details concerning the required test.	

NEUTRON PHYSICS

§ 204.701 Neutron sources.

Item	Description	Fee
204.701a	Determination of ratio of neutron emission rate of unknown source to primary standard in $MnSO_4$ bath or graphite column	$355.00

§ 204.702 Neutron instruments.

Item	Description	Fee
204.702a	Calibration of a set (one to three) of thermal neutron dosimeters	$75.00

§ 204.703 Neutron irradiation of foils.

Item	Description	Fee
204.703a	Activation of a set (one to four) of foils in the NBS standard thermal neutron flux geometry	$50.00

PART 205—ANALYTICAL AND INORGANIC CHEMISTRY

PURE SUBSTANCES

§ 205.101 Measurement of physical properties of primary reference fuels used for octane number determination.

Item	Description	Fee
205.101a	Measurement of physical properties of primary reference fuels used for octane number determination	$445.00

(Sec. 9, 3, Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a)

PART 206—MECHANICS

VIBRATION

Sec.
206.001 Vibration pickups.

SOUND

206.101 Acoustic measurements.

PRESSURE AND VACUUM

206.201 Pressure measurements.

FLUID MECHANICS

206.301 Aerodynamical measurements.
206.302 Fluid meters, including gas measuring instruments.

ENGINEERING MECHANICS

206.401 Hardness tests.
206.402 Calibration of load cells with remote reading electrical indicators.
206.403 Special mechanical tests of devices, materials and structures.
206.404 Calibration of proving rings.
206.405 Calibration of elastic force measuring devices.

AUTHORITY: §§ 206.001 to 206.405 issued under sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a.

VIBRATION

§ 206.001 Vibration pickups.

(a) This applies to the calibration of displacement, velocity, and acceleration types of vibration pickups. A report of calibration is issued.

(b) Each piezoelectric acceleration pickup which is used with a cathode-follower or amplifier shall be accompanied by the cathode-follower or amplifier, the power supply if other than batteries, and the output and connecting cables.

(c) Each piezoelectric acceleration pickup whose output is read directly with a high impedance meter can be but need not be accompanied by the meter, but shall be accompanied by the output cable and a suitable shielded connector.

(d) When instruments submitted are found to be unsuitable for test or unre-

liable, a charge will be made to cover the cost of the work done.

Item	Description	Fee
206.001a	Static calibration on a tilting support in the earth's gravitational field for accelerations up to 1g, the acceleration of gravity, with an error not greater than 0.001g. Calibration for 10 different applied accelerations	$86.00
206.001b	Static calibration on a centrifuge at 4 different applied accelerations up to 80g for not more than two orientations with an estimated error not greater than 0.2 percent of the applied acceleration (8 calibration points). Acceleration will be determined at radii measured to designated reference points on the pickup case	120.00
	For additional tests or measurements required to determine location of seismic mass, fees will be charged to cover the cost of work done.	
206.001c	Dynamic calibration of velocity pickups weighing up to 2 pounds in the frequency range from 10 cps to 2000 cps at double displacement amplitudes up to 0.4 inch or accelerations up to 10g, whichever is less. The pickup is subjected to sinusoidal motion on an electrodynamic vibration standard previously calibrated by the reciprocity method. The estimated errors of the applied accelerations do not exceed 1 percent for frequencies up to 900 cps and 2 percent above 900 cps. The magnitude and phase angle of the calibration factor are determined at up to 10 frequencies. The magnitude of the calibration factor is determined for up to three accelerations at each frequency (up to 30 calibration points)	275.00
	For each test frequency in excess of 10 an additional charge equal to one-tenth of the fee is made.	
206.001d	Dynamic calibration of acceleration and displacement pickups weighing up to 2 pounds in the frequency range of 10 cps to 2000 cps at double displacement amplitudes up to 0.4 inch or accelerations up to 10g, whichever is less. The pickup is subjected to sinusoidal motion on an electrodynamic vibration standard previously calibrated by the reciprocity method. The estimated errors of the applied accelerations do not exceed 1 percent for frequencies up to 900 cps and 2 percent above 900 cps. The magnitude and phase angle of the calibration factor are determined at up to 10 frequencies. The magnitude of the calibration factor is determined for up to three accelerations at each frequency (up to 30 calibration points)	350.00
	For each test frequency in excess of 10 an additional charge equal to one-tenth of the fee is made.	
206.001e	Dynamic calibration of piezoelectric acceleration pickups weighing up to 4 ounces in the frequency range of 10 cps to 2000 cps at double displacement amplitudes up to 0.4 inch or accelerations up to 10g, whichever is less or if requested, up to 20g at 2 unspecified frequencies. The pickup is subjected to sinusoidal motion on an electrodynamic vibration standard previously calibrated by the reciprocity method. The estimated errors of the applied accelerations do not exceed 1 percent for frequencies up to 900 cps and 2 percent above 900 cps. The magnitude of the calibration factor is determined for up to three accelerations at up to 10 frequencies within a specified range (up to 30 calibration points)	255.00
	For each test frequency in excess of 10 an additional charge equal to one-tenth of the fee is made.	
206.001z	For special tests not covered by the above schedule, such as dynamic calibrations of pickups weighing more than 2 pounds, calibrations of small lightweight piezoelectric ceramic pickups over an extended frequency range up to 20,000 cps, or calibrations at higher accelerations, fees will be charged dependent on the nature of the test.	

SOUND

§ 206.101 Acoustic measurements.

Item	Description	Fee
206.101a	Pressure calibration of Western Electric Co. Type 640AA condenser microphone or equivalent from 50 to 10,000 cps at discrete frequencies. Response given in terms of open-circuit voltage per unit sound pressure applied to the microphone	$205.00
206.101b	Pressure calibration of Western Electric Co. Type 640AA condenser microphone or equivalent from 50 to 20,000 cps at discrete frequencies. Response given in terms of open-circuit voltage per unit sound pressure applied to the microphone	280.00
206.101c	Free-field calibration of microphone satisfying the requirements of the Type-L laboratory microphone specified in American Standards Association Standard Z24.8-1949; 50 to 15,000 cps at discrete frequencies; plane of diaphragm either perpendicular or parallel to the direction of sound propagation. Response given in terms of open-circuit voltage per unit free-field sound pressure	280.00
206.101d	Calibration of earphones; applied voltage response as prescribed in the American Standards Association Specification Z24.9-1949, at not more than 20 frequencies between 100 and 10,000 cycles per second	320.00
206.101e	Calibration of Pure Tone Audiometers for screening purposes at 9 fixed frequencies	820.00
206.101f	Artificial ear at audiometric frequencies	430.00
206.101g	Sound absorption coefficient, obtained by reverberation room method, using 72 square feet of material at frequencies of 125, 250, 500, 1000, 2000, and 4000 cycles per second	430.00
	In case of tests on acoustical plasters or paintability tests, any construction work or painting done by the Bureau is charged to the sponsor in addition to the fee given above.	
206.101h	Sound absorption coefficient by impedance tube method at 500 cycles per second in the laboratory on acoustical tiles, 1' x 1'	110.00
206.101i	Sound transmission loss, wall panel, 71" x 88" at frequencies of 125, 175, 250, 350, 500, 700, 1000, 1500, 2000, 3000, and 4000 cycles per second	430.00
	The construction of the wall panel is the responsibility of the sponsor of the test.	
206.101j	Sound transmission loss, floor panel, 71" x 88" at frequencies of 125, 175, 250, 350, 500, 700, 1000, 1500, 2000, 3000, and 4000 cycles per second, plus impact sound transmission	575.00
	The construction of the floor panel is the responsibility of the sponsor of the test.	
206.101z	For special tests not covered by the above schedule, fees will be charged dependent on the nature of the test.	

PRESSURE AND VACUUM

§ 206.201 Pressure measurements.

Item	Description	Fee
206.201a	Dead weight piston gages other than controlled clearance gages (also called dead weight gage testers and pressure balances). Determination of effective area of the piston by comparison with a pressure standard, up to 5 test points at room temperature, 20 to 25° C. Pressure fluid may be air, up to to 600 psi, petroleum oil up to 60,000 psi, or synthetic lubricant (dioctyl sebacate) up to 120,000 psi. Determination of effective area requires previous weighing of piston assembly and the use of calibrated weights. If NBS has weights to fit, the gage may be calibrated using NBS weights. For each piston	$285.00
206.201b	Controlled clearance piston gages. Determination of effective area, jacket pressure for zero clearance and variation of effective area with jacket pressure. Test is made on an assembly of piston, cylinder and jacket, not to be disassembled later. Determination of effective area requires previous weighing of piston assembly and the use of calibrated weights. If NBS has weights to fit, the gage may be calibrated using NBS weights. Inquiry should be made as to the parts to be submitted. Fee usually does not exceed $1,000.00. Work to be charged at cost.	
206.201c	Barometers, Fortin or similar types, range 28 to 31 inches of mercury, tube bore 0.5 inch or greater, calibration at room temperature (20° to 25° C) and atmospheric pressure	220.00
206.201d	Manometers, manually operated, with tube bore 0.5 inch or greater, in which both mercury surfaces are observed. Range to 100 inches of mercury, calibration test at room temperature (20° to 25° C) up to ten test points. Fee usually does not exceed $1,000.00. Work to be charged at cost.	
206.201e	Manometers, with tube bore 0.5 inch or greater, in which both mercury surfaces are observed, and of design which permits calibration in terms of length, temperature, etc. Calibration of scale and thermometer, performance verified by comparison with pressure standard. Fee usually does not exceed $1,000.00. Work to be charged at cost.	
206.201z	For special tests not covered by the above schedule. For example, calibration of pressure gages of high precision and stability. Work to be charged at cost.	

FLUID MECHANICS

§ 206.301 Aerodynamical measurements.

Item	Description	Fee
206.301a	Wind speed indicators—calibration of cup, vane and thermal type anemometers, pitot tubes and venturi tubes at wind speeds within the range 2 to 90 miles per hour or (optional) 10 to 170 miles per hour	$83.00
206.301z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 206.302 Fluid meters, including gas measuring instruments.

Item	Description	Fee
206.302a	Dry gas meters, rated capacity 600 cubic feet per hour or less—testing with prover in laboratory at 2 rates of flow and reporting	$60.00
206.302b	Displacement type meters for liquids which can be calibrated with water at rates of flow not exceeding 300 gpm—testing at 1 to 5 rates of flow and reporting	180.00
206.302c	Rate of flow meters, self-contained and direct reading; for gases, capacities not over 25 cfm; for liquids, capacities not not over 300 gpm—calibration at not more than 5 rates of flow and reporting	295.00
206.302d	Orifices, flow nozzles, laminar flow meters, and similar differential head meters for use in pipes up to and including 2-inch pipe; calibration with water or air at a number of flow rates sufficient to develop a performance curve	430.00
206.302e	Additional fee for meter in pipes larger than those included in item 206.302d. For each 1-inch increment of size over 2-inch	28.00
206.302f	Meters listed in item 206.302d, when 2 or more are used interchangeably in the same mounting—for each meter or orifice plate after the first	130.00
206.302g	Water current meters—rating of Price, Pigmy and Hoff types at not over 8 velocities, and reporting results in equation form only, or in graph form only	43.00
206.302h	Water current meters—rating of Hoff type) at 10 or 11 velocities and reporting results in both graphical and equation forms, for each propeller	56.00
206.302i	Water current meters—Ekman type, for each propeller submitted therewith; rating at not over 8 velocities and reporting results in both graphical and equation form	120.00
206.302j	Water current meters—all types, for each velocity in excess of the eight covered by items 206.302g to 206.302i above	5.00
206.302k	Furnishing results of water current meter calibration in graphical form, or in equation form when requested subsequent to completion of test	11.00
206.302z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

ENGINEERING MECHANICS

§ 206.401 Hardness tests.

Item	Description	Fee
206.401a	Determination of Brinell number of a block to be used for calibration purposes, 3 separate indentations on each specimen	$41.00

§ 206.402 Calibration of load cells with remote reading electrical indicators.

(a) These fees apply to calibration of load cells with reading electrical indicators.

(b) Individual load cells or load cell systems must be accompanied by readout or indicating equipment and all associated cables and fixtures.

(c) Up to 10 different loads are applied consecutively without return to zero.

(d) For each load in excess of 10, an additional fee equal to one-tenth of the applicable fee is charged.

(e) When devices submitted are found to be unsuitable for test or unreliable, the test may be discontinued and a charge will be made to cover the cost of the work done.

Item	Description	Fee
	Capacity not exceeding 10,000 pounds:	
206.402a	Compression	$70.00
206.402b	Tension	81.00
206.402c	Tension and compression	125.00
	Capacity exceeding 10,000 pounds but not exceeding 111,000 pounds:	
206.402d	Compression	87.00
206.402e	Tension	120.00
206.402f	Tension and compression	165.00
	Capacity exceeding 111,000 pounds but not exceeding 200,000 pounds:	
206.402g	Compression	255.00
	Capacity exceeding 200,000 pounds but not exceeding 300,000 pounds:	
206.402h	Compression	300.00
206.402z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 206.403 Special mechanical tests of devices, materials and structures.

(a) These fees apply to all mechanical tests of devices, materials and structures performed in the Mechanics Division not covered by other fee schedules.

(b) The charge for special mechanical tests is made on the basis of the hours of service furnished by members of the staff.

(c) Where tests require travel outside the limits of 30 miles from the Bureau, transportation and subsistence charges will be added to the service charge.

(d) The time shall be computed as the number of official working hours from the time the members of the staff leave the National Bureau of Standards until they return to it plus any overtime spent on the tests.

Item	Description	Fee
206.403a	Service of a member of the staff of grade GS–9, or any higher grade, per hour	$12.00
206.403b	Service of a member of the staff of grades below GS–9, per hour	7.00

§ 206.404 Calibration of proving rings.

(a) These fees apply to calibration of proving rings suitable for use as laboratory or transfer standards.

(b) These fees apply to calibration in accordance with Sections I, II, III, and IV of the Appendix of Circular of the National Bureau of Standards C454.

(c) Up to 10 independent loads for compression or tension are applied.

(d) Fees for complete calibrations apply to rings submitted for initial calibration.

(e) For each load in excess of 10, an additional fee equal to one-tenth of the applicable fee for complete calibration or recalibration is charged.

(f) When devices submitted are found to be unsuitable for test or unreliable, a test may be discontinued and a charge will be made to cover the cost of the work done.

Item	Description	Fee
	Complete calibration of proving rings, capacity not exceeding 10,000 pounds:	
206.404a	Compression	$140.00
206.404b	Tension and compression	225.00
	Recalibration of proving rings, capacity not exceeding 10,000 pounds:	
206.404c	Compression	98.00
206.404d	Tension and compression	170.00
	Complete calibration of proving rings, capacity exceeding 10,000 pounds but not exceeding 111,000 pounds:	
206.404e	Compression	175.00
206.404f	Tension and compression	280.00
	Recalibration of proving rings, capacity exceeding 10,000 pounds but not exceeding 111,000 pounds:	
206.404g	Compression	125.00
206.404h	Tension and compression	230.00
	Complete calibration of proving rings, capacity exceeding 111,000 pounds but not exceeding 200,000 pounds:	
206.404i	Compression	390.00
	Recalibration of proving rings, capacity exceeding 111,000 pounds but not exceeding 200,000 pounds:	
206.404j	Compression	280.00
	Complete calibration of proving rings, capacity exceeding 200,000 but not exceeding 300,000 pounds:	
206.404k	Compression	470.00
	Recalibration of proving rings, capacity exceeding 200,000 pounds but not exceeding 300,000 pounds:	
206.404l	Compression	345.00
206.404z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test.	

§ 206.405 Calibration of elastic force measuring devices.

(a) These fees apply to calibration of elastic force measuring devices of a type suitable for use as laboratory or transfer standards.

(b) Before a device is accepted for calibration under this schedule it will be inspected for damage, wear and operability. Loading surfaces, tension adaptors and pulling rods must be complete and suitable for use with NBS equipment. The device must be uniquely and permanently marked with the manufacturers serial numbers and rated capacities.

(c) A temperature coefficient must be supplied by the submitter of the device.

(d) Devices will be overloaded repeatedly to approximate 10% in excess of the manufacturers rated capacity.

(e) Up to 10 different independent loads for compression or tension will be applied.

(f) For each load in excess of 10, an additional fee equal to one-tenth of the applicable fee is charged.

(g) When devices submitted are found to be unsuitable for test or unreliable, a test may be discontinued and a charge will be made to cover the cost of the work done.

Item	Description	Fee
	Capacity not exceeding 10,000 pounds:	
206.405a	Compression	$99.00
206.405b	Tension	115.00
206.405c	Tension and compression	175.00
	Capacity exceeding 10,000 pounds but not exceeding 111,000 pounds:	
206.405d	Compression	125.00
206.405e	Tension	175.00
206.405f	Tension and compression	235.00
	Capacity exceeding 111,000 pounds but not exceeding 200,000 pounds:	
206.405g	Compression	280.00
	Capacity exceeding 200,000 pounds but not exceeding 300,000 pounds:	
206.405h	Compression	345.00
206.405z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the tests.	

PART 208—METALLURGY

ELECTRODEPOSITION

§ 208.601 Standard thickness samples of electroplated coatings.

Item	Description	Fee
208.601a	Standard thickness samples of electroplated coatings, set of four samples	$15.00
	Individual samples, each	4.00

(Sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a)

PART 210—BUILDING RESEARCH

FIRE RESISTANCE

Sec.
210.201 NBS fire resistance tests of building components.

THERMAL CONDUCTIVITY

Sec.
210.601 Thermal conductivity.

AUTHORITY: §§ 210.201 and 210.601 issued under sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a.

FIRE RESISTANCE

§ 210.201 NBS fire resistance tests of building components.

Requests for tests should be made in writing to the Fire Research Section, National Bureau of Standards, Washington 25, D.C., and should be accompanied with detail drawings and specifications of the structures proposed for test. Tests will be conducted for the public only until adequate facilities become available elsewhere.

Item	Description	Fee
210.201a	Fire endurance test of a floor, roof, or ceiling, 13½ by 18 feet	$3,850.00
210.201b	Fire endurance test of structural column 13 feet high subjected to load, or without load	3,200.00

THERMAL CONDUCTIVITY

§ 210.601 Thermal conductivity.

Item	Description	Fee
210.601a	Determination for calibration purposes of the thermal conductivity of a selected pair of specimens, by means of guarded hot-plate apparatus (conforming to ASTM C177) for mean temperatures between 20° and 130° F (ordinarily 20°, 30°, 75° and 130° F), per determination at one mean temperature	$130.00
210.601b	Determination of thermal conductivity of a metal specimen for a range of mean temperatures from −150° to 750° C, per specimen	1,625.00
	Required sample is a cylindrical bar, 46.0 cm long, and approximately 2.54 cm uniform diameter.	
210.601c	Determination of thermal conductivity of a metal specimen for a range of mean temperatures from −150° to 200° C, per specimen	1,150.00
	Required sample is a cylindrical bar, 46.0 cm long, and approximately 2.54 cm uniform diameter.	
210.601d	Determination of thermal conductivity of a metal specimen for a range of mean temperatures from 100° to 750° C, per specimen	1,250.00
	Required sample is a cylindrical bar, 46.0 cm long, and approximately 2.54 cm uniform diameter.	
210.601z	For special tests not covered by the above schedule, fees will be charged dependent upon the nature of the test and time required.	

PART 215—PHYSICAL CHEMISTRY

ORGANIC CHEMISTRY

Sec.
215.301 Synthesis of C^{14} labeled sugars and related products.
215.302 Synthesis of tritium-labeled carbohydrates.

AUTHORITY: §§ 215.301 and 215.302 issued under sec. 9, 31 Stat. 1450, as amended; 15 U.S.C. 277. Interprets or applies sec. 7, 70 Stat. 959; 15 U.S.C. 275a.

ORGANIC CHEMISTRY

§ 215.301 Synthesis of C^{14} labeled sugars and related products.

Item	Description	Fee
215.301a	Synthesis of 10 microcuries of of C^{14} labeled sugars and related products, Type I (carbohydrates labeled at carbon 1)	$12.50
	Each microcurie	1.25
215.301b	Synthesis of 10 microcuries of C^{14} labeled sugars and related products, Type 2 (carbohydrates labeled in positions other than carbon 1)	19.00
	Each microcurie	2.00

§ 215.302 Synthesis of tritium-labeled carbohydrates.

Item	Description	Fee
215.302a	Synthesis of 10 microcuries of tritium-labeled carbohydrates (carbohydrates labeled without extensive alteration of the carbon skeleton)	$12.50

R. D. HUNTOON,
Deputy Director.

[F.R. Doc. 63-7618; Filed, July 25, 1963; 8:45 a.m.]